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ABSTRACT

This curriculum package contains materials developed through a partnership of the Association of Rotational Molders, El Paso Community College (Texas), and the College of DuPage (Illinois). The materials, which were developed during a 2-day DACUM (Developing a Curriculum) process, are based on national skill standards and designed for manufacturing firms conducting their own in-house training, community college customized training, and continuing education programs. The package includes a DACUM chart, course outline overview, and nine course outlines. Each course outline includes the following: course description; course length; prerequisite competencies; course objectives; integration of academic and workplace skills; foundation skills; workplace competencies; method of instruction; method of evaluation; materials and texts; and course outline. The course topics are as follows: introduction to the rotational molding process and operation; safety; material handling; start-up and shut-down procedures; handling molded parts; mold setup and mold change; preparing and servicing the mold; quality control; and processing and troubleshooting. Appended are the following: annotated listing of 34 recommended resource materials and websites; list of the employment skills identified by the Secretary's Commission on Achieving Necessary Skills; and list of the 210 National Voluntary Skill Standards for Advanced High Performance Manufacturing. (MN)

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ED 428 289

Rotational Molding Process Technician

Instructional Program Package

developed through a partnership between

The Association of Rotational Molders
and
El Paso Community College (TX)
The College of DuPage (IL)

1998

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Association of Rotational Molders

Rotational Molding Process Technician

Instructional Program Package

developed in partnership with

El Paso Community College (TX)

The College of DuPage (IL)

Earlier this year, the Association of Rotational Molders teamed with the El Paso (Texas) Community College and the College of DuPage, Illinois to conduct a two-day "DACUM." DACUM, an acronym for Developing A CurriculUM, is an interactive process that analyzes an occupation systematically. A panel of occupational experts, in this case ARM members, performed this analysis. The panel's effort resulted in a comprehensive chart describing the specific tasks that Rotational Molding Process Technicians perform. Using the tasks defined during the DACUM, three curriculum developers wrote a set of comprehensive course outlines for the training of Rotational Molding Process Technicians. These outlines have been compiled with sets of national skill standards and resource listings to provide ARM members with a comprehensive set of flexible educational materials.

The curriculum package, now available to ARM members, is flexible and can be used as a whole, or in part, to meet the training needs of individual companies. Members may choose to use the materials to conduct their own in-house training, or may use them in conjunction with community college customized training or continuing education program delivery.

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DACUM Chart

for

Rotational Molding Process Technician

Rotational Molding Process Technician: A technician, following safe operating procedures and "best manufacturing" practices, prepares molds, performs mold change overs, and operates machinery to produce quality rotationally molded parts that meet customer requirements.

START-UP AND SHUT-DOWN PROCEDURE A	A1 Assess mold condition	A2 Determine start-up procedures	A3 Perform operator maintenance check	A4 Check/input operation settings	A5 Assemble proper tools and equipment	A6 Monitor oven temperature	A7 Preheat molds
	A8 Follow machine shut down procedures	A9 Empty/pre-charge molds	A10 Shut down/turn off utilities	A11 Employ mold change over procedures when necessary	A12 Report mold or machine problems to appropriate personnel		

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PERFORM MOLD CHANGE OVER B	B1 Verify mold compatibility	B2 Check new mold for clamps and springs	B3 Acquire last-run information	B4 Set brake	B5 Remove existing mold	B6 Interpret Process Sheet (set time, temperature, and rotation speed; adjust machine settings)	B7 Position mold
	B8 Mount mold to machine	B9 Verify change-over procedure	B10 Balance spindle/arm				

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RUNNING MOLDING CYCLE C	C1 Open mold	C2 Apply mold release if necessary	C3 Obtain required materials	C4 Check vent tubes	C5 Check air and/or gas systems and regulators	C6 Install inserts or metal components to be molded in part	C7 Weigh out materials
	C8 Charge mold	C9 Ensure proper material distribution	C10 Close mold	C11 Initiate molding cycle	C12 Remove mold components	C13 De-mold part	C14 Perform initial secondary functions/ operations (e.g., remove flashing)
	C15 Record data for part	C16 Inspect part	C17 Perform secondary functions/ operations (e.g., trimming)	C18 Identify part for traceability	C19 Monitor mold operations	C20 Determine disposition of off-spec parts	C21 Adjust process
	C22 Notify supervisor of variances						

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PREPARING OR SERVICING MOLD D	D1 Check mold mounting to machine	D2 Clean and inspect parting lines	D3 Clean and inspect vents	D4 Reapply mold release if necessary	D5 Check clamps, bolts and receivers	D6 Verify components to process sheets	D7 Install components
	D8 Remove/clean foreign materials	D9 Notify supervisors of variances					
MATERIAL HANDLING E	E1 Locate stored materials	E2 Follow MSDS information	E3 Verify materials on process sheet (identify resin types; identify color pigment)	E4 Blend materials according to process sheet	E5 Maintain inventory	E6 Prevent contamination (e.g., clean buckets, bins, & hoppers)	E7 Maintain good housekeeping practices
	E8 Verify non-resin components to process sheet	E9 Follow serialized materials' processes (e.g., humidity, climate)	E10 Identify, collect, re-grind scrap materials	E11 Weigh shot/charge			

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DE-MOLDING CYCLE F	F1 Position mold	F2 Apply brakes	F3 Attach overhead hoist and/or other mold handling equipment	F4 Remove bolts and release clamps	F5 Remove insert pins	F6 Remove/clean vent tubes	F7 Follow mold opening procedures
	F8 Select/use special removal tools						
HANDLING MOLDED PARTS G	G1 Follow post-curing procedures	G2 Perform special handling techniques (e.g., white gloves, anti-static)	G3 Follow special handling procedures (e.g., protective bags)	G4 Perform initial secondary functions/ operations (e.g., remove flashing)	G5 Assess parts for quality	G6 Identify parts for traceability	G7 Perform secondary functions/ operations
	G8 Conduct performance testing	G9 Monitor production quantity requirements	G10 Monitor quality requirements	G11 Package parts	G12 Store and inventory parts		

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PERFORM QUALITY CHECKS H	H1 Interpret drawings/ blueprints	H2 Acquire QC equipment	H3 Inspect parts	H4 Provide molded first-run sample for quality check	H5 Obtain quality specifications	H6 Interpret data	H7 Measure products with equipment
	H8 Record findings	H9 Verify and report process changes	H11 Notify supervisor/QC personnel of variances	H12 Determine corrective action - carry out	H13 Follow safety and good housekeeping practices		

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Rotational Molding Process Technician

Instructional Program Package

The complete program package includes nine courses, described below, covering 500 hours of instruction. The courses used and the sequence of instruction will differ based on the company's needs and students' prior knowledge and experience. Complete course outlines follow.

✔ Introduction to the Rotational Molding Process and Operation

An overview course designed for students who are entering the field of rotational molding with no previous experience. Leads the students through the basic process, machine types, operations, controls, molds used for the process, and polymers. Course also introduces basic quality standards for molded parts. Discussions include various types of plastic processing, and the place of rotational molding within the industry. 80 hours

✔ Safety

Introduction to the basic principles of occupational safety and health, providing a general understanding with implementation skills relating to the rotational molding process technician. Emphasis will be placed on general principles as well as occupationally specific tasks. 40 hours

✔ Material Handling

Introduction to the basic principles of material handling for the rotational molding process technician. The topics covered will include product/material identification, packaging specifications, scrap handling and handling work in process. Safety considerations will be reinforced throughout the course.
30 hours

✔ Start-Up & Shut-Down Procedures

Introduction to the basic principles of start-up and shut-down for the rotational molding process technician. Topics covered will include assessing mold condition, start-up procedures, operator maintenance checks, operation settings, precharging molds, preheating molds, emptying molds, shut-down/turn-off of utilities, and performing mold change-over procedures. Standard safety procedures will be reinforced. 30 hours

✔ Handling Molded Parts

Course covers the skills rotational molding processing technicians need to perform secondary functions / post-molding operations to rotationally molded plastic parts. Special handling instructions, procedures, and techniques are part of this course. 40 hours

✔ Mold Set-Up & Mold Change

Course introduces the students to the "know-how" necessary to properly install a rotational mold to a rotational molding machine. Instruction also covers proper use of specific tools needed to perform this task. Students will develop the basic skills needed to work in a rotational molding environment as a mold set-up person. 40 hours

✔ Preparing & Servicing the Mold / Production

Covers skills necessary to perform duties of the rotational molding operator. Instruction includes preparing and filling the mold(s) with plastics for the cycle, and attending to the machine to de-mold parts using auxiliary equipment and necessary tools. 70 hours

✔ Quality Control

The rotational molding process technician is central to part quality. This course will cover reading and understanding customer specifications, and implementation of basic quality techniques and procedures. 50 hours

✔ Processing & Troubleshooting

Course covers skills necessary to perform comprehensive troubleshooting of the entire rotational molding process. Instruction will include troubleshooting involving various rotational molding machines, auxiliary equipment and plastic materials. Students will work through each step of the molding process and will develop the ability to systematic ally analyze problems, determine causes and propose process modifications. This is a very vital course for a process technician. 120 hours

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Rotational Molding Process Technician

Course Outline

Introduction to the Rotational Molding Process and Operation

Course Description

An overview course designed for students who are entering the field of rotational molding with no previous experience. Leads the students through the basic process, machine types, operations, controls, molds used for the process, and polymers. Course also introduces basic quality standards for molded parts. Discussions include various types of plastic processing, and the place of rotational molding within the industry.

Course Length: 80 hours (recommended)

Prerequisite Competencies

This is an introductory course, however, students should possess basic competence in reading, writing and arithmetic skills.

It is recommended that students in this course take the following course in the program package simultaneously:

- Safety

Course Objectives

Upon successful completion of this course, the student will be able to:

✔ Differentiate between rotational molding process vs. other plastic processing technologies.

✔ Define the purpose of rotational molding.

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- ✔ Describe basic safety practices in a rotational molding environment.
- ✔ Identify various rotational molding machines.
- ✔ Define nomenclature of machine.
- ✔ Describe the purpose of machine components.
- ✔ Describe a complete rotational molding cycle.
- ✔ Identify various rotational mold types.
- ✔ Set basic machine controls.
- ✔ Identify selected (common) polymers frequently used in the rotational molding process.
- ✔ Identify defective molded parts.

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

Foundation Skills:

- ✔ Basic Skills: Reading, Writing, Listening, Speaking
- ✔ Thinking Skills: Seeing Things in the Mind's Eye, Knowing How to Learn
- ✔ Personal Qualities: Responsibility

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Workplace Competencies

- ✔ Information Skills: Acquiring and Evaluating Information, Organizing and Maintaining Information, Interpreting and Communicating Information
- ✔ Technology Utilization Skills: Applying Technology to a Task

National Skill Standards for Advanced High Performance Manufacturing: The National Coalition for Advanced Manufacturing (NACFAM) has developed and validated occupational skill standards for workers in advanced high-performance manufacturing. Based on information from front-line production workers, NACFAM, in conjunction with the U.S. Departments of Labor and Education established standards that detail the core knowledge and skills that workers in manufacturing firms must possess to perform their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✔	Written Knowledge Test	45%
✔	Performance Exercises	45%
✔	Team Exercises	10%

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Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be particularly valuable (see addendum Resource Materials). Additionally, current materials reflecting the nature and realities of the rotational molding industry should be incorporated. These materials include industry periodicals, and manufacturer's product information dealing with rotational molding machines and plastic materials. Web sites, sponsored by ARM as well as by rotational molding companies and their suppliers also will provide students supplementary information regarding the industry (see addendum Resource Materials for some suggested website addresses).

Course Outline

A. The Rotational Molding Industry

1. Introduction to Plastic Processing Technologies

    a. injection molding
    b. compression molding
    c. thermoset molding
    d. thermoforming
    e. calendering
    f. blow-molding
    g. rotational molding
    h. other processes

2. Overview of History of Rotational Molding

    a. industry pioneers
    b. industry trends

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B. Safety and Rotational Molding

1. General Introduction

a. shop safety
b. equipment safety
c. hazardous materials

C. The Rotational Molding Machine

1. Types of Machines
2. Machine Controls
3. Machine Components
1. Process Controls

D. The Rotational Molding Process

1. Elements of Cycle/Curing

a. preparing the machine
b. preparing the mold
c. running the cycle

E. Molds for Rotational Molding

1. Purpose of Molds
2. Materials used for Mold-Making
1. Types of Molds (advantages/disadvantages)

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F. Commonly used Plastics for Rotational Molding

1. Overview of plastic materials

   a. PVC
   b. polyethylene
   c. nylons
   d. performance modifiers and additives

G. Quality in Rotational Molding

1. Purpose of Quality
2. Definition of Quality and Control
3. Definition of Quality Part
4. Identify Molded Part Defects

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Rotational Molding Process Technician

Course Outline

Safety

Course Description

Introduction to the basic principles of occupational safety and health, providing a general understanding with implementation skills relating to the rotational molding process technician. Emphasis will be placed on general principles as well as occupationally specific tasks.

Course Length: 40 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing and arithmetic skills.

It is recommended that students in this course take the following course in the program package simultaneously, unless the student has previous experience in the field:

- Introduction to the Rotational Molding Process and Operation

Course Objectives

Upon successful completion of this course the student will be able to:

✔ Identify specific OSHA and EPA requirements for working in the rotational molding industry. (A12)

✔ Communicate his/her role in the company/laboratory safety program and procedures. (A12)

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- ✔ Locate and interpret MSDS information sheets. (E2)
- ✔ Identify and properly use required personal protective equipment.
- ✔ Perform emergency procedures per stated policies.
- ✔ Identify and locate machine safety and guarding controls (B4)
- ✔ Utilize proper methods of hazardous material handling, storage and disposal. (E2)
- ✔ Identify and locate machine safety and guarding controls. (B4)
- ✔ Communicate his/her role in the "Lock-out-Tag-out" procedures.
- ✔ Demonstrate hand tool and power tool safety. (C14) (C5)
- ✔ Demonstrate basic safety techniques for the workplace (B5, E7)
- ✔ Construct a safety checklist for a specific machine and workspace (B10, C5, E7)

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

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Foundation Skills

- ✔ Basic Skills: Reading, Writing, Listening
- ✔ Thinking Skills: Decision Making, Seeing Things in the Mind's Eye, Reasoning
- ✔ Personal Qualities: Responsibility, Self Management

Workplace Competencies

- ✔ Interpersonal: Participates as a Member of a Team, Teaches Others New Skills, Exercises Leadership
- ✔ Information: Acquires & Evaluates Information, Interprets & Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks

National Skill Standards for Advanced High Performance Manufacturing: The National Coalition for Advanced Manufacturing (NACFAM) has developed and validated occupational skill standards for workers in advanced high-performance manufacturing. Based on information from front-line production workers, NACFAM, in conjunction with the U.S. Departments of Labor and Education established standards that detail the core knowledge and skills that workers in manufacturing firms must possess to perform their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Additionally, the rotational molding process technician's role in plant safety includes development of the following general skills as time on the job increases:

- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret technical manuals and instructions.
- ✔ Provide detailed and accurate reports of incidents and accidents.
- ✔ Be an active team member of company's safety program.
- ✔ Promote a safe work environment for fellow workers.

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Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✓	Written Knowledge Test	50%
✓	Performance Tests	40%
✓	Team Exercises	10%

Materials and Texts

No specific text is required for this course. Due to the specific nature of the rotational molding equipment, much of this can be obtained from machine manuals or company procedures. Many good general safety training materials are available from the National Safety Council and other short-topic training materials from other sources. Please see Resource Materials addendum for more specific information.

Course Outline

A. General Safety Requirements and Regulation

1. OSHA Regulations regarding worker safety
2. OSHA Regulations regarding plastics industry and rotational molding
3. Reporting responsibilities and worker's role
4. EPA regulations and responsibilities for workers
5. MSDS information and procedures

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A. Company-specific safety requirements and regulations

1. Company safety program
2. Emergency plan and worker response
3. Worker responsibility and participation
4. Company reporting requirements

C. Basic Safety Techniques

1. Safety awareness
2. Proper lifting techniques
3. General fire safety
4. General first aid

D. Personal Protective Equipment

1. Eye and face protection
2. Foot wear and hand wear
3. Other

E. Hand Tools and Power Tool Safety

1. Identification and proper use of hand tools
2. Identification and proper use of hand power tools
3. Workplace arrangements and housekeeping

F. Power Equipment Safety

1. Molding Machine Safety
2. Electrical Safety
3. Machine Controls
4. Guarding and Interlocks
5. Warning Labels
6. Gases and air pressure

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G. Secondary Equipment

1. Electrical Safety
2. Machine Controls
3. Guarding and Interlocks
4. Warning Labels

H. Identification of Hazardous and Dangerous Conditions

1. Using proper tools and techniques
2. Working with hot materials
3. Pinch points
4. Pressurized systems
5. "Lock-out-Tag-out" system responsibilities
6. Worker responsibilities for a safe workplace

I. Pro-active Safety

1. How to spot and report safety concerns
2. Working with others to be safe
3. Safety beyond the workplace

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Rotational Molding Process Technician

Course Outline

Material Handling

Course Description

Introduction to the basic principles of material handling for the rotational molding process technician. The topics covered will include product/material identification, packaging specifications, scrap handling and handling work in process. Safety considerations will be reinforced throughout the course.

Course Length: 30 hours (recommended)

Prerequisite Competencies

Students should possess a basic competence in arithmetic including addition, subtraction, multiplication, division, and units of measurement. In addition, basic reading skills are required.

Recommended prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation
  (or experience in field)
- Safety

Course Objectives

Upon successful completion of this course the student will be able to:

✔ Identify plastic materials via labeling, tagging and process specifications. (C3)

✔ Identify non-resin components via labeling, tagging, and process specifications (C6, E8)

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- ✔ Locate and interpret MSDS information sheets (E2)
- ✔ Obtain the proper materials and quantities per process specifications. (C3, C7, E4, E3)
- ✔ Perform mixing and blending operations per specifications. (E4, E6, E11)
- ✔ Identify and collect unused materials for proper storage. (E7, E10, E6)
- ✔ Utilize proper methods of material handling, storage and disposal. (E2, E5, E7)
- ✔ Identify and follow special handling of process parts. (G2, G3, G7, G12)
- ✔ Communicate production quantities and inventory data to proper personnel. (E5, G9, G12)
- ✔ Demonstrate the proper use of materials handling equipment. (C14, C5)
- ✔ Demonstrate basic safety techniques for the workplace (B5, E7)

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

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Foundation Skills:

- ✔ Basic Skills: Reading, Performing Arithmetic & Mathematical Operations, Speaking, Listening
- ✔ Thinking Skills: Decision Making, Knowing How to Learn
- ✔ Personal Qualities: Responsibility

Workplace Competencies

- ✔ Resources: Materials & Facilities
- ✔ Interpersonal: Participates as a Member of a Team, Serves Clients/Customers
- ✔ Information: Acquires & Evaluates Information, Organizes & Maintains Information, Interprets & Communicates Information
- ✔ Systems: Understands Systems
- ✔ Technology: Selects Technology, Applies Technology to Tasks

National Skill Standards for Advanced High Performance Manufacturing: The National Coalition for Advanced Manufacturing (NACFAM) has developed and validated occupational skill standards for workers in advanced high-performance manufacturing. Based on information from front-line production workers, NACFAM, in conjunction with the U.S. Departments of Labor and Education established standards that detail the core knowledge and skills that workers in manufacturing firms must possess to perform their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Additionally, the rotational molding process technician's role in materials handling is changing. Evolution of the industry may include the development of the following general skills as time on the job increases:

- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret customer specifications and instructions.
- ✔ Provide detailed and accurate reports of production information.

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- ✔ Be an active team member of company's production improvement program.
- ✔ Utilize computer technology to input production data an generate bar codes, etc.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study of topics such as mathematics, weights and measures, as well as plastic and non-plastic components is recommended.

Method of Evaluation

✓	Written Knowledge Test	50%
✓	Performance Tests	40%
✓	Team Exercises	10%

Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders may be valuable (see addendum Resource Materials). Current Material Safety Data Sheets, process sheets, and other product labels and information direct from suppliers will be valuable as primary text. If this course is conducted as a customized course, specific company methods for handling materials and processing information will be critical.

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Course Outline

A. Process Sheet Information

1. Understanding the process sheet
2. Verifying materials on process sheet
3. Verifying non-resin components to process sheet
4. Customer requirements

B. Product/Material Identification Procedures

1. Identifying resin types
2. Labeling / tagging / bar coding
3. Labels: packaging material / raw materials
4. Following MSDS information
5. Identifying color pigment
6. Locating and storing materials
7. Staging Locations for Specific Materials
   a. Responsibility
      - preventing contamination (e.g. clean buckets, bins, hoppers)
   b. Safety
      - following specialized materials processes (e.g. humidity, climate)

C. Weights and Measures

1. Units of weight in rotational molding
2. Units of measure in rotational molding
3. Weighing and measuring equipment

D. Blending

1. Blending equipment
2. Blending materials according to process sheet
3. Weighing shot/charge

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E. Scrap Handling Procedures

1. Proper segregation
2. Cleaning
3. Contaminated material
4. Re-grind scrap materials
   a. collecting
   b. identifying
   c. tools & equipment
   d. safety

F. "Work in Process" Packaging Specifications

1. Work instructions per customer
   a. lot traceability

G. Customer Packaging Specifications

1. Currugated cartons
2. Poly bags
3. Skid size
4. Quantity

H. Specialized Materials Handling Equipment

1. Fork truck
2. Pallet jack
3. Overhead lift

I. Safety Awareness

1. Working with others to be safe

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Rotational Molding Process Technician

Course Outline

Start-Up & Shut-Down Procedures

Course Description

Introduction to the basic principles of start-up and shut-down for the rotational molding process technician. Topics covered will include assessing mold condition, start-up procedures, operator maintenance checks, operation settings, precharging molds, preheating molds, emptying molds, shut-down/turn-off of utilities, and performing mold change-over procedures. Standard safety procedures will be reinforced.

Course Length: 30 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing, and arithmetic skills.

Recommended prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation (or experience in field)
- Safety
- Material Handling

Some basic blueprint reading skills are encouraged.

Course Objectives

Upon successful completion of this course the student will be able to:

✔ Read set-up chart/process sheet and perform related tasks (Follow set-up procedures).

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- ✔ Assemble/acquire tools necessary to perform start-up and shut-down procedures. (A5)
- ✔ Assess mold condition and determine if mold is securely attached to machine's arm. (A1)
- ✔ Identify and select the proper material with respect to resin, color, additives, etc. (C3)
- ✔ Set up machine controls. (A2,A4)
- ✔ Perform operator maintenance checks. (A3)
- ✔ Perform the empty/pre-charging of the mold based on process specifications. (A9)
- ✔ Set and monitor oven temperatures. (A6)
- ✔ Perform pre-heat procedures if necessary. (A7)
- ✔ Perform shut-down procedures according to specification. (A10)
- ✔ Perform mold change-over procedures. (A11)
- ✔ Report mold/machine problems to appropriate personnel. (A12)

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should

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incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

Foundation Skills

- ✔ Basic Skills: Reading, Speaking, Listening
- ✔ Thinking Skills: Seeing Things in the Mind's Eye, Reasoning, Knowing How to Learn
- ✔ Personal Qualities: Responsibility, Self Management

Workplace Competencies

- ✔ Resources: Time, Materials & Facilities
- ✔ Interpersonal: Participates as a Member of a Team
- ✔ Information: Organizes & Maintains Information, Interprets & Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks, Maintains Equipment

National Skill Standards for Advanced High Performance Manufacturing: The National Coalition for Advanced Manufacturing (NACFAM) has developed and validated occupational skill standards for workers in advanced high-performance manufacturing. Based on information from front-line production workers, NACFAM, in conjunction with the U.S. Departments of Labor and Education established standards that detail the core knowledge and skills that workers in manufacturing firms must possess to perform their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Additionally, the rotational molding process technician's role in start-up and shut-down procedures will include development of the following general skills as time on the job increases:

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- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret technical drawings and customer requirements.
- ✔ Provide detailed and accurate production information.
- ✔ Be an active team member of company's production improvement program.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✓	Written Knowledge Test	50%
✓	Performance Exercises	40%
✓	Team Exercises	10%

Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders may be valuable (see addendum Resource Materials). Actual set-up charts and process sheets from manufacturers will be valuable as primary text. Equipment manuals also will be helpful. If this course is conducted as a customized course, specific company methods specifying start-up/shut-down procedures will be critical.

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Course Outline

A. Start-up Procedures

1. Assessing mold condition.
2. Reading and interpreting set-up charts/process sheets.
3. Identifying materials; resin, color, and additives.
4. Machine functions and controls.
5. Control settings – time, temperature, cooling, speeds,.
6. Functions/conditions – clamps, bolts, shields.
7. Functions/conditions – vent tubes.

B. Loading Mold with Material / Pre-Charging Mold

1. Plastic Materials

a. resins
b. additives
c. colorants
d. modifiers

2. Measurements

a. metric
b. English
c. volumes
d. linear
e. area

C. Shutdown Procedure

1. De-molding last part.

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2. Prepare mold for long-term or short-term shut-down.

   a. use of solvents, lubricants, greases.

3. Sequenced shut-down procedures

   b. utility controls
   c. other special controls and equipment

4. Last shot routing procedures for quality purposes.

5. Verification of standard shut-down checklist.

6. Assessment of mold condition

   a. vents
   b. parting lines
   c. clamping
   d. surface area of cavities, etc.

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Rotational Molding Process Technician

Course Outline

Handling Molded Parts

Course Description

Course covers the skills rotational molding processing technicians need to perform secondary functions / post-molding operations to rotationally molded plastic parts. Special handling instructions, procedures, and techniques are part of this course.

Course Length: 40 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing and arithmetic skills.

Recommended prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation (or experience in field)
- Safety

Course Objectives

Upon successful completion of this course, the student will be able to:

✔ Assess parts for quality. (G5)

✔ Perform secondary functions such as removing flash, trimming of molded parts, drilling, etc. (G7)

✔ Use gauges.

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- ✔ Read and use part drawings. (G10)
- ✔ Assemble (screwing, bolting, etc.) (G7)
- ✔ Use jigs and fixtures. (G7)
- ✔ Perform post-curing procedures as per requirements. (G1)
- ✔ Perform testings with molded parts. (G8)
- ✔ Inventory molded parts/maintain inventory. (G12)
- ✔ Store molded parts / Locate stored materials. (G12)
- ✔ Read and follow MSDS information and requirements. (G10)
- ✔ Monitor production requirements. (G9)
- ✔ Follow and perform special handling procedures such as use of glues, anti-static agents, protective bags, etc. (G2)
- ✔ Packaging of molded parts as required. (G11)
- ✔ Monitor quality requirements as first-line quality inspector. (G5)
- ✔ Identify molded parts for traceabililty. (G6)
- ✔ Read and interpret basic part and assembly drawings. (G10)
- ✔ Safely handle molded parts.
- ✔ Use hand tools safely.

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

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Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

Foundation Skills

- ✔ Basic Skills: Reading, Listening, Arithmetic & Mathematical Operations
- ✔ Thinking Skills: Decision Making, Seeing Things in the Mind's Eye, Knowing How to Learn, Reasoning
- ✔ Personal Qualities: Responsibility, Self Management

Workplace Competencies

- ✔ Resources: Materials & Facilities
- ✔ Interpersonal: Participates as a Member of a Team, Serves Clients/Customers
- ✔ Information: Acquires & Evaluates Information, Interprets & Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks

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to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

The rotational molding process technician's role in handling molded parts is growing due to the rapid growth and evolution of the industry. The following general skills should be included as time on the job increases:

- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret customer specifications and instructions.
- ✔ Provide detailed and accurate production information.
- ✔ Be an active team member of company's production improvement program.
- ✔ Use computer for production and inventory control.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✔	Written Test	45%
✔	Lab/Performance Test	45%
✔	Team Work and Exercises	10 %

Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be valuable (see addendum Resource Materials). Additionally, print and multi-media materials covering the use of hand-tools and precision measuring instruments will be important. If this course is conducted for

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a specific company, it will be imperative to use that company's materials handling information/guidelines/regulations.

Course Outline

A. General Assessment of Molded Parts

1. Verifying process procedures
2. Verifying material requirements and other quality requirements
3. Verifying part performance requirements
4. Assessing total quality of part based on customer requirements

B. Part Handling Procedures

1. Identifying part print
2. Measuring part dimensions
3. Checking and identifying colorant and color
4. Applying hand tools
5. Performing finishing/secondary operations:
   a. buffing
   b. routing
   c. drilling
   d. machine setting
   e. cleaning
   f. final packing, etc.

C. Packaging Procedures

1. Special handling procedures
2. Customer instructions
3. Production traceability
4. Lot-to-Lot traceability
5. Labeling and shrink-wrapping

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D. Production Monitoring

1. Identifying inventory at hand
2. Weighing/counting production
3. Identifying scrap
   a. collecting
   b. segregating
   c. tracking

4. Quantity and Overruns

E. Quality Requirements

1. Monitoring quality
   a. use of measuring tools
   b. application of special handling instruction
   c. visual inspection

2. Quality Testing: performance test
   a. use of gauges
   b. use of testing equipment
   c. critical dimensions
   d. special testing methods

F. Inventory Control

1. Warehousing of production
2. Basics of production control
3. Traceability of inventory
4. Production logs

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G. Quality Control

1. Introduction to quality principles
2. Introduction to the basics of:
   a. ISO
   b. ISO 9000
   c. ISC 9002

   (Based on customer needs.)

H. Safety

1. Product handling
2. Machine safety review
3. Personal safety
4. Safety procedures
5. Hazardous materials
6. MSDS
7. Safety equipment
8. Plant safety
9. Environmental considerations

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Rotational Molding Process Technician

Course Outline

Mold Set-Up & Mold Change

Course Description

Course introduces the students to the "know-how" necessary to properly install a rotational mold to a rotational molding machine. Instruction also covers proper use of specific tools needed to perform this task. Students will develop the basic skills needed to work in a rotational molding environment as a mold set-up person.

Course Length: 40 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing and arithmetic skills.

Students taking this course should understand and be able to use rotational molding machine controls on a safe, satisfactory level. If students have not had experience in the field, it is recommended that they complete the following courses in from this program package:

- Introduction to the Rotational Molding Process and Operation
- Start-Up and Shut-Down Procedures
- Material Handling

Additional recommended pre-requisite courses from this program package:

- Safety

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Course Objectives

Upon successful completion of this course the student will able to:

- ✔ Verify mold compatibility with machine for set-up. (B5)
- ✔ List components needed for mold set-up (B6)
- ✔ Check and make assessment for new mold set-up. (B6)
- ✔ Check clamps, springs and other components to be in working order.
- ✔ Operate machine controls needed for mold change/set-up purposes (such as brake) (B2)
- ✔ Remove mold/molds from arm(s). (B3)
- ✔ Position new mold on arm properly. (B8)
- ✔ Obtain information on previous run if available (B1)
- ✔ Interpret process sheet and set machine controls accordingly. (B4)
- ✔ Verify proper mold change procedures (B9)
- ✔ Set-up/mount mold to machine (B7)
- ✔ Balance spindle/arm (B10)
- ✔ Use equipment and tools essential for mold change and set-up.
- ✔ Demonstrate the ability to perform a mold change and use of tools/equipment in a safe manner.

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✔ Communicate with superiors and co-workers needed to prepare the set-up process in rotational molding.

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

Foundation Skills:

- ✔ Basic Skills: Reading, Speaking, Listening
- ✔ Thinking Skills: Decision-Making, Knowing How to Learn, Reasoning
- ✔ Personal Qualities: Responsibility, Self-Management

Workplace Competencies

- ✔ Interpersonal: Participates as a Member of a Team, Serves Clients/Customers
- ✔ Information: Acquires & Evaluates Information, Interprets and Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks

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their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Additionally, the rotational molding technician's role as a set-up technician is changing. Evolution of the industry may include development of the following general skills as time on the job increases:

- ✔ Transfer of learning and apply principles of one situation to another.
- ✔ Provide detailed and accurate production and technical information/report in a timely manner.
- ✔ Read instruction/specifications related to the performance of the job.
- ✔ Use a computer for technical (set-up) and production purposes.
- ✔ Be an active member of the company's safety and production improvement program.

Method of instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✓	Written Knowledge Test	45%
✓	Hands-on/lab Performance Test	45%
✓	Team Work and Exercises	10%

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Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be particularly valuable (see addendum Resource Materials). Use of machine manuals will be critical.

Important note to the instructor: Due to the exclusive nature of the performance of mold set-up technicians, tasks are highly specific and subject to the type of machine, type of mold and auxiliary equipment. Set-up technicians must be trained to the company's methods beyond generic set-up training.

Supplemental texts, VHS tapes and computer-assisted instruction may help bolster student skills in necessary arithmetic, measuring and shop math.

Course Outline

A. Rotational Molding Machines

1. General overview
2. Machine types
3. Machine controls
4. Machine operator
5. Machine in cycle

B. Rotational Molds

1. Introduction
2. Basic Mold types

C. Mold Set-Up

1. Equipment:

a. hoists
b. grinders

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c. mixing equipment
d. drying equipment
e. heating (?) equipment

2. Machine/Mold Arms

a. single mold set-up
b. multiple mold set-up
c. mold spindles
d. spindle unit
e. tools for mold set-up
f. positioning mold on arm/clamping
g. balancing mold

D. Machine Controls

1. Setting controls
2. Rotating arms
3. Operating controls needed for mold set-up
4. Setting mold rotation
5. Setting heat controls / season
6. Setting cooking controls / season
7. Times
8. Molding sequence
9. Speed controls (rotational)
10. Micro-processor

E. Communication

1. Data sheets
2. Various prints
3. Procedures
4. PC Basics (optional)

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Rotational Molding Process Technician

Course Outline

Preparing & Servicing the Mold / Production

Course Description

Covers skills necessary to perform duties of the rotational molding operator. Instruction includes preparing and filling the mold(s) with plastics for the cycle, and attending to the machine to de-mold parts using auxiliary equipment and necessary tools.

Course Length: 70 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing and arithmetic skills.

Recommended prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation (or experience in field)
- Safety
- Material Handling

Course Objectives

Upon successful completion of this course, the student will be able to:

✔ Check mold mountings. (D1)

✔ Remove molding(s) from mold(s).

✔ Clean and inspect parting lines. (D2)

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- ✔ Clean and inspect vents. (D3)
- ✔ Apply mold release when/if it is necessary. (D4)
- ✔ Check clamps, bolts and receivers.(D5)
- ✔ Remove/clean foreign materials. (D8)
- ✔ Verify components to process sheets/setup charts. (D6)
- ✔ Install components. (D7)
- ✔ Recharge mold with plastic.
- ✔ Close mold.
- ✔ Check and adjust proper balance of mold on arms/spiders.
- ✔ Notify superiors of variances. (D9)
- ✔ Position the mold for de-molding (F1)
- ✔ Apply the brakes. (F2)
- ✔ Use crane, hoist and other mold-handling equipment. (F3)
- ✔ Open mold/release clamps, bolts, pins. (F4)
- ✔ Remove insert pins. (F5)
- ✔ Clean, inspect, replace vent tubes. (F6)
- ✔ Select/use special tools for part removal. (F8)

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

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Integration of Academic and Workplace Skills

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Foundation Skills

- ✔ Basic Skills: Reading, Speaking, Listening
- ✔ Thinking Skills: Decision Making, Knowing How to Learn, Reasoning
- ✔ Personal Qualities: Responsibility, Self-Management

Workplace Competencies

- ✔ Resources: Time, Materials & Facilities
- ✔ Interpersonal: Participates as a Member of a Team, Serves Clients/Customers
- ✔ Information: Acquires & Evaluates Information, Interprets and Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks, Maintains & Troubleshoots Equipment

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Additionally, the rotational molding process technician's role in preparing and servicing the mold procedure will include development of the following general skills as time on the job increases.

- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret technical drawings and customer requirements..
- ✔ Provide detailed and accurate reports of production information.
- ✔ Be an active team member of company's production improvement program.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✓	Written Knowledge Test	50%
✓	Performance Tests	40%
✓	Team Exercises	10%

Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be particularly valuable (see addendum Resource Materials). Additionally, machine operation manuals will be helpful.

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Course Outline

A. The Rotational Molding Machine

1. Operation/Cycle
2. Machine Components
3. Basic Controls

B. Preparing the Mold for the Process/De-Molding and Charging

1. Mold performance requirements.
2. Mold fastening components, equipment and tools.
3. Visual inspection of mold.
4. Operating duties during production.

   a. cleaning – vents, surfaces, parting lines
   b. lubricating – components/mold release
   c. inspecting – mold conditions, part assessment
   d. communications – reporting variances, concerns, etc.
   e. changing components when necessary
   f. removing product from molds
   g. general basic assessment of conditions
   h. measuring plastic resin
   i. charging mold with plastic resin
   j. using hand tools such as impact wrenches, etc.
   k. auxiliary equipment
   l. installing components to mold
   m. interpreting process sheet
   n. applying brakes
   o. positioning mold

C. Auxiliary Equipment

1. Hoists
2. Cranes

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3. Power and Impact Tools
4. Other de-molding tools and equipment
5. Granulators
6. Packing

    a. following instructions
    b. production routing procedures
    c. special packing information/product handling

C. Quality Assessment

1. Visual inspection
    a. defects – surface finish, blemishes, colors, etc.

2. Measuring Tools

    a. straight ruler
    b. vernier
    c. micrometer
    d. weighing

3. Interpreting Data

    a. process sheet
    b. technical/material data
    c. customer's specifications
    d. prints (graphs)

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Rotational Molding Process Technician

Course Outline

Quality Control

Course Description

The rotational molding process technician is central to part quality. This course will cover reading and understanding customer specifications, and implementation of basic quality techniques and procedures.

Course Length: 50 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, writing and arithmetic skills, including addition, subtraction, multiplication, divisions and units of measurement.

Students should have some work experience in the field, or have completed the following prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation
- Safety
- Handling Molded Parts

Course Objectives

Upon successful completion of this course, the student will be able to:

✔ Read and interpret customer drawing and specifications (H1, H5)

✔ Communicate his/her role in the company's quality program and procedures. (H9, H11, H8)

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- ✔ Make simple part measurements. (H7)
- ✔ Identify and properly use inspection tools. (H7)
- ✔ Assess and monitor general part quality. (H6, H9, G5, G10)
- ✔ Record quality information in the proper format. (H8, H6)
- ✔ Properly identify parts for the quality system. (H4, G6)
- ✔ Follow proper procedures for disposal of reject parts. (H12, C20)
- ✔ Communicate quality information to co-workers and supervisors. (H11, D9)
- ✔ Develop quality-minded work habits. (G10)

(Numbers/letters following each objective relate to skills identified in the ARM DACUM chart.)

Integration of Academic and Workplace Skills

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Foundation Skills

- ✔ Basic Skills: Reading, Writing, Speaking, Listening, Arithmetic & Mathematical Operations
- ✔ Thinking Skills: Seeing Things in the Mind's Eye, Knowing How to Learn, Reasoning
- ✔ Personal Qualities: Responsibility, Self Management, Integrity/Honesty

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Workplace Competencies

- ✔ Resources: Materials & Facilities
- ✔ Interpersonal: Participates a Member of a Team, Serves Clients/Customers, Exercises Leadership, Works with Diversity
- ✔ Information: Acquires & Evaluates Information,
  Organizes & Maintains Information,
  Interprets and Communicates Information
- ✔ Systems: Understands Systems, Monitors & Corrects Performance
- ✔ Technology: Selects Technology, Applies Technology to Tasks

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Additionally, the rotational molding process technician role in quality control will require the development of the following general skils as time on the job increases:

- ✔ Transfer of learning and apply principles from one situation to another.
- ✔ Read and interpret technical drawings and customer requirements.
- ✔ Provide detailed and accurate reports of quality-related problems.
- ✔ Be an active team member of company's quality program.
- ✔ Use computer for production and inventory control.

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Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✓	Written Knowledge Test	50%
✓	Performance Tests	40%
✓	Team Exercises	10%

Materials and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be particularly valuable (see addendum Resource Materials). Due to the various types of quality systems used in the rotational molding industry, much of the instructional materials can be developed from company quality manuals and company procedures. Blueprints and written product specifications will be critical instructional materials. Many good general quality, short-topic training materials are available from the sources such as the American Society of Quality Control. (see addendum Resource Materials)

Course Outline

A. Quality Assurance Concepts

1. Quality Assurance Systems
   a. procedures quality manuals (FDA, ISO, MIL, SPEC)
   b. continuous improvements (CPK reports, cost of quality reports)
   c. role of the technician in quality

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2. What defines a defect
   a. meeting specifications
   b. nonconformance

B. Customer Specifications and Product/Materials Specifications

1. Reading blueprints/drawings

2. Interpreting written specifications

C. Inspection Techniques/Methods

1. visual
2. functional
3. dimensional
2. measuring systems
3. measuring instruments
4. proper use of types of equipment
5. safe handling
6. calibration
7. consistency of measurement technique
8. critical specifications
   a. spec sheet/drawing call outs

D. How to Monitor Process to Stay in "Spec"

1. Process control basic concepts
   a. process control limits and specifications

E. Inspection and Testing

1. Appropriate data and sampling procedures
   a. frequency and quantity
   b. recording information
   c. reference spec sheet/drawing

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d. comparison against a standard
e. measurable or not

F. Procedure to Handle and Document Defects During Production

1. Notification of proper personnel
2. Quarantine Procedures
3. Production/Quality reports

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Association of Rotational Molders

Rotational Molding Process Technician

Course Outline

Processing & Troubleshooting

Course Description

Course covers skills necessary to perform comprehensive troubleshooting of the entire rotational molding process. Instruction will include troubleshooting involving various rotational molding machines, auxiliary equipment and plastic materials. Students will work through each step of the molding process and will develop the ability to systematic ally analyze problems, determine causes and propose process modifications. This is a very vital course for a process technician.

Course Length: 120 hours (recommended)

Prerequisite Competencies

Students should possess basic competence in reading, and writing. Students should also possess an understanding of shop math relating to the mechanical industry in order to understand and implement problem-solving techniques. In addition, students should possess a basic understanding of production economics.

It is recommended that students enrolling in this course have experience in the Rotational Molding Industry. If students have no experience, it is recommended that students take the following prerequisite courses from this program package:

- Introduction to the Rotational Molding Process and Operation
- Safety
- Material Handling Procedures
- Start-Up & Shut-Down Procedures
- Preparing & Servicing the Mold
- Mold Set-Up & Mold Change
- Handling Molded Parts
- Quality Control

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Course Objectives

Upon successful completion of this course the student will be able to:

- ✔ Identify rotational molding machine types and components.
- ✔ Identify polymeric materials used in the rotational molding process (fundamental characteristics of flow structure and processing conditions).
- ✔ Set material (plastic) condition required for the processing of selected plastics (proper temperature setting for melt-flow characteristics for uniform wall thickness).
- ✔ Define the rotational mold's purpose, performance requirements, components and how it works (mold types and basic requirements to perform).
- ✔ Set rotational molding machine controls (heating, cooling temperature setting, primary secondary rotation, plate and arm rotation for various types of machines).
- ✔ Set up, control and adjust auxiliary equipment such as dryers, and secondary operation equipment
- ✔ Troubleshoot rotational molding processing problems utilizing analytic/measure, Decide and Act process. Examples of probable processing problems that the student should be able to solve:
    - part sticking
    - excessive flash on molded parts
    - parting lines
    - long cycle
    - long oven cycle
    - pock marks
    - blow-hole problems
    - low-impact strength

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- discoloration
- warping
- voids
- uneven wall thickness
- porosity
- bubbles
- poor stiffness
- underfused parts
- venting
- air-traps
- mold porosity
- moisture
- streaks in part
- holes in part
- etc.

✔ Start-up and shut-down a rotational molding machine (observing shop procedures).

✔ Perform a mold change. (This process includes removing existing mold, balance, spindle arm.)

✔ Prepare mold for cycle

✔ Run the molding cycle

✔ Define the purpose of shielding.

✔ Perform de-molding (removing product from mold).

✔ Perform handling of molded parts.

✔ Check molded parts and evaluate for quality.

✔ Perform material handling duties.

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- ✔ Interpret prints, data sheets, MSDS information.
- ✔ Check, set, control machine, equipment and shop safety.
- ✔ Communicate with fellow employees and supervision.
- ✔ Check production output.
- ✔ Use gauges and other measuring tools needed to perform duties.
- ✔ Apply critical thinking in processing. (How we deal with cause and effect: considering economic ramifications when choosing solutions after problem-solving.)
- ✔ Perform any technical job that is necessary to perform in a rotational molding process environment.
- ✔ Write process sheet based on machine control setting.

Integration of Academic and Workplace Skills

Secretary's Commission on Achieving Necessary Skills (SCANS): Workers in today's workplace must have basic skills in reading, writing, and mathematics, higher order thinking skills, and application of interpersonal skills in order to be successful. For this reason, learning activities leading to the accomplishment of the above objectives should incorporate components that increase basic skills simultaneously, and encourage collaborative/team work and problem-solving. See addendum SCANS for complete listing of skills. Specific SCANS skills pertinent to this course include:

Foundation Skills

- ✔ Basic Skills: Reading, Writing, Listening, Speaking, Arithmetic & Mathematical Operations
- ✔ Thinking Skills: Creative Thinking, Decision Making, Problem Solving, Seeing Things in the Mind's Eye, Knowing How to Learn, Reasoning

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✔ Personal Qualities: Responsibility, Sociability, Self Management, Integrity/Honesty

Workplace Competencies

Resources: Time, Money, Materials & Facilities, Human Resources
Interpersonal: Participates as a Member of a Team, Teaches Others New Skills, Serves Clients/Customers, Exercises Leadership, Negotiates, Works with Diversity
Information: Acquires & Evaluates Information, Organizes & Maintains Information, Interprets & Communicates Information
Systems: Understands Systems, Monitors & Corrects Performance, Improves or Designs Systems
Technology: Selects Technology, Applies Technology to Tasks, Maintains & Troubleshoots Equipment

National Skill Standards for Advanced High Performance Manufacturing: The National Coalition for Advanced Manufacturing (NACFAM) has developed and validated occupational skill standards for workers in advanced high-performance manufacturing. Based on information from front-line production workers, NACFAM, in conjunction with the U.S. Departments of Labor and Education established standards that detail the core knowledge and skills that workers in manufacturing firms must possess to perform their jobs effectively. Please see attached addendum National Voluntary Skill Standards for a detailed subset of the standards that relate to the curricula for Rotational Molding Process Technician. This subset should be used by program developers and instructors to augment, or "round-out" the highly industry-specific nature of this course and other courses in this program package.

Additionally, the rotational molding process technician will have to "wear many hats" in relation to troubleshooting. This will require development of the following general skills as time on the job increases.

✔ Read and interpret technical drawings related to shop performance and customer requirements.

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- ✔ Use of leverage: transfer of learning and apply principles from one situation to another.
- ✔ To provide accurate and detailed production reports and processing related problems.
- ✔ Be an active team member of company's safety, quality and improvement program.

Method of Instruction

Due to the hands-on nature of the Rotational Molding field, this course should be taught using a dynamic combination of lecture, followed by demonstration and hands-on laboratory or on-the-job training activities. When possible, collaborative team activities should be incorporated. Additionally, the use of multi-media resources for remedial and self-study will enhance instruction.

Method of Evaluation

✔	Written Knowledge Test	45%
✔	Performance/Hands-On Test	45%
✔	Team Exercises/Team Work	10%

Material and Texts

No specific textbook is recommended for this course. Segments of materials published by the Association of Rotational Molders will be particularly valuable (see addendum Resource Materials). Machine manuals, process sheets, product specifications, blueprints, and other industry information will be critical for use in this course. Additionally, quality control/technology materials, including materials covering the use of precision measuring instruments may be necessary, based on students' backgrounds. See addendum Resource Materials for listing of materials.

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Course Outline

A. Overview of Rotational Molding

1. Materials

2. Machines

3. Molds

4. Design Principles
   a. an overview of rotational molding

5. Processing and Troubleshooting
   a. overview of evaluation process
   b. processing problems
   c. material preparation
   d. mold preparation
   e. process preparation/process factors
   f. special considerations

B. Rotational Molding Machines

1. The rotational molding process

2. Various types of machines:
   a. rock and roll
   b. box oven
   c. shuttle
   d. clampshell
   e. verticle
   f. fixed arm
   g. independent arm

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C. Molds for the Rotation Molding Process

1. Introduction

2. Mold types
   a. sheet metal molds
   b. cast molds
   c. electroformed molds
   d. vapor-formed molds
   e. machined molds
   f. non-metallic molds

3. Mold construction/design basics
   a. venting
   b. nominal wall
   c. corners
   d. angles
   e. ribs
   f. radii
   g. holes
   h. undercuts
   i. treads
   j. inserts
   k. tolerances
   l. finishing/decorating
   m. mold maintenance

E. Processing of Plastic Materials

1. Introduction to plastics

2. Types of plastics
   a. thermosets

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b. thermoplastics

3. Flow behavior and the structure of plastics
   a. amorphous
   b. crystalline
   c. Newtonian and Non-Newtonian flow Behaviors

4. Resin Selection based on performance needs and end use requirements

5. Processing of commonly used plastics/study of processing parameters
   a. PVC
   b. vinyl plasticol
   c. polyethylene
   d. polypropylene
   e. polycarbonate
   f. nylon
   g. polyester
   h. cross-linked polyethylene
   i. liquid polymers

6. Additives and Modifiers
   a. anti-static agents
   b. cross-linking agents
   c. fillers
   d. flame-retardants
   e. flow-modifiers
   f. foaming agents
   g. heat stabilizers
   h. impact modifiers
   i. UV stabilizers
   j. fibers
   k. nucleating agents
   l. colorants
   m. release agents

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7. Rotational Molding Process Control
   a. principals of process control
   b. part property control
   c. advantage of process control
   d. quality and process control
   e. SPC applied in process
   f. control system types–advantage and disadvantages

8. Plastic identification, performance and testing methods ASTM

9. Basic Shop Math
   a. fractions
   b. equations
   c. circles
   d. decimals
   e. perimeters
   f. ratios
   g. triangles
   h. percentages
   i. volume
   j. angles
   k. areas

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Rotational Molding Process Technician

Instructional Program Package

Addendum

Resource Materials

Available/Recommended

Resource Materials

for

Rotational Molding Processing Technician Students

Materials available through the

Association of Rotational Molders

2000 Spring Road, Suite 511

Oak Brook, IL 60523

http://www.rotomolding.org/educational.htm

✔ The Unlimited Possibilities

Video: Demonstrates the rotational molding process and includes a wide variety of products manufactured.

✔ Before You Begin

Video: Excellent training tool that demonstrates the responsibilities of the machine operator.

✔ Rotational Molding– The Basic Process

Text: Introduction to all aspects and applications of the rotational molding process.

✔ Glossary of Terms

Text: Includes common terms and definitions related to equipment, molds, quality control, colorants and additives.

✔ Good Manufacturing Practices

Video: Allows employees to see the importance and impact of adhering to solid manufacturing practices.

✔ Shielding

Video: Explores variables which influence wall thickness, and demonstrates various ways to control the rate of heat transfer through the mold wall.

✔ Curing

Video: Describes how the basic mechanism of the rotational molding process affects the quality of the part produced, and provides ideas for practical tests that cam be used to make sure correct cure has been achieved.

✔ Rotational Molding Troubleshooting

Text: A handy reference for machine operators who may need assistance during the molding process.

✔ The Introductory Guide to Designing Rotationally Molded Plastic Parts

Text: Valuable guide covers process capabilities and applications and is directed toward improved product design and quality. Contains useful formulas used by production personnel and engineers.

✔ Resin Properties for Rotational Molding

Text: Test responses and specifications from a variety of resin types and manufacturers.

✔ Quality Assurance Manual

Text: Includes the basic guidelines required to start a quality assurance program.

✔ Rotation Magazine

Provides reports on research findings, committee activities, new materials and equipment, corporate news, as well as meetings and events sponsored by the Association.

Published Texts:

✔ Rotational Moulding of Plastics, 2nd Edition
edited by R.J. Crawford
1996 / John Wiley & Sons, Inc.
New York, NY
ISBN 0471963038

The second edition of this book, first published in 1992, has been extensively updated and expanded by its authors, who are leaders n their specialities within the field of rotational moulding. It provides an introduction to the subject, as well as giving comprehensive coverage of the state-of-the-art. There are new chapters on rotational moulding of liquid polymers and on pin-holes and bubbles in rotationally molded products. Contents: Introduction to Rotational Moulding; Rotational Moulding Machines; Sheet Metal Moulds; Cast Aluminum Moulds; Design of Rotational Moulded Products; Design Case Studies; Process Control for Rotational Moulding; Molding of Liquid Polymers; Pin-holes and Bubbles in Rotationally Moulded Products.

✔ Rotational Molding:
An Introduction to Industry, Design, Material, Troling and Processing
1998 / by Glenn Beall
ISBN 1569902607

This book is due to be published in October 1998. Will be available on-line through http://www.amazon.com.

✔ Precision Measuring Tools
Bergwall Productions, Inc.
8 Ponds Edge Drive
P.O. Box 2400
Chadds Ford, PA 19317

✔ The Quality Technician's Handbook, 3/e
Gary K. Griffith
1996 / Prentice Hall Career & Technology
ISBN 0-13-437328-6

An ASQC best-seller, -- this text covers a variety of the basic skills that contribute to outgoing quality at the technician level. Operators, machinists, inspectors, quality technicians and associate quality engineers will find its coverage of quality assurance, quality control and inspection topics useful as either learning aid or reference. Also, The Quality Technician's. Handbook is now one of the primary reference books used by people taking the ASQC Certification Exams.

✔ Occupational Safety and Health:
for Technologists, Engineers, and Managers, 3/e
by David L. Goetsch,
1998 / Prentice Hall Career & Technology
ISBN 0-13-924085-3

For Safety Management/Safety and Health Management courses at the

undergraduate level; also intended for use in community colleges, vocational-technical centers and corporate settings that offer programs, courses, workshops and/or seminars in Occupational Health and Safety. With an eye on the future and a finger on the pulse of today's rapid changes due to global competition, this straightforward, state-of-the-art guide addresses key issues, concerns, and factors relating specifically to modern workplace environments in the safety and health professions. Highly functional, it draws immediate connections between principles and practices in real-world settings, and includes the latest OSHA standards and approaches safety and health issues from the perspective of TQM and global competitiveness.

✔ Basic Technical Mathematics:
A Sourcebook of Applications

and

Basic Occupational Mathematics

J. Weston Walch
321 Valley Street
P.O. Box 658
Portland, ME 04104-0658
http://www.walch.com

Good general shop math texts for remedial or educationally disadvantaged technical students, or for workers who need to brush up on applied shop math while taking additional training.

Materials available through the:
National Safety Council
1121 Spring Lake Drive
Itasca, IL 60143-3201
(630) 285-1121; fax (630) 285-1315
http://www.nsc.org/

✔ Materials Handling
Video: 15 Min. Title No. 2427
This program looks at one of the most important aspects of on the job safety - handling materials safely. Workers learn how: to plan the job; potential hazards; importance of personal protective equipment; proper lifting techniques; and the safe use of hand trucks, carts and other equipment used in materials handling. Also available in Spanish.

✔ Powered Equipment in the Warehouse: Safety on the Job
Video: 12 Min. Title No. 2615

The correct operation and maintenance of warehouse equipment is covered. Shows: handling equipment on loading docks; checking trailer wheels; inspecting dock boards; working inside a rail car; and forklift operation. Safety rules for stacking, along with tips for safe operation of hoists and conveyors are reviewed.

✔ Indoor Cranes: Safe Lifting
Video: 19 Min. Title No. 2649
Specifically designed for non-licensed operators, gives them all they need to safely operate several types of cranes: jib cranes; monorails; gantry cranes; and bridge cranes. Covers: pre-operation safety inspection; rigging techniques; lifting; and moving.

✔ Chemical Safety: General Principles
Video: 16 Min. Title No. 2303
A general overview of handling hazardous chemicals, and the safety procedures required to work with chemicals. Covers flammables, corrosives, and solvents.

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✔ Hazardous Materials Leaks, Drips, and Spills Cleanup
Video: 14 Min. Title No. 2516
Trains workers in the cleanup process - basic procedures; awareness; emergency responses; types of materials to use during cleanups; and prevention techniques. Also available in Spanish

✔ Machine Hazard Awareness
18 Min. Title No. 2700
How to identify and recognize mechanical hazards; understand guarding principles; and recognize guarding qualities. Shows some of the various hazards which may be present in the workplace by interviews with workers who use machines with guards in their jobs. Also available in Spanish.

✔ Working with Machinery: Safety on the Job
17 Min. Title No. 2091
Teaches safety from two perspectives - protecting the worker and safeguarding the machine. Covers dangers to eyes, ears, hands and lungs; and precautions for each are described. Also illustrates the safety equipment to use, and how to use it. Also available in Spanish.

✔ Danger Zone: Personal Protective Equipment
12 Min. Title No. 2249
An overview of personal protective equipment, offering tips on proper use, fit and maintenance. Covers: hard hats; hearing protection; eye protection; respiratory protection; protective clothing; hand protection and foot protection.

✔ Chemical Hazard Identification and Training
Introduction and Overview
19 Min. Title No. 2375
Discusses the laws requiring workers to be trained when working with hazardous chemicals, and be advised of the necessary safety precautions to be used when handling them. Gives workers an understanding of their role in being informed and staying informed. Also available in Spanish.

Additional WEB Resources

- ✔ Rotational Molders Discussion Group
  http://www.polysort.com/discuss/rotational.asp

- ✔ Rotation
  The Magazine of the International Rotational Molding Industry
  http://www.rotationmag.com

- ✔ Rotational Moulding Research Centre
  Queen's University of Belfast
  http://www.qub.ac.uk/mpeng/mmeng/rotomould/rotoweb.htm

- ✔ Polysort: Plastics and Rubber Industry Information
  http://www.polysort.com/

- ✔ Modern Plastics & Modern Plastics International
  The Global Magazines of Plastics Processing
  http://www.modplas.com/welcom.htm

- ✔ American Society of Quality
  http://www.asqc.org/

- ✔ Safety Online
  http://www.safetyonline.net/

Association of Rotational Molders

Rotational Molding Process Technician

Instructional Program Package

Addendum
Secretary's Commission
on Achieving Necessary Skills
(SCANS)

Secretary's Commission on Achieving Necessary Skills (SCANS)

In 1990 the United States Secretary of Labor appointed the Secretary's Commission on Achieving Necessary Skills (SCANS) to determine the skills people need to succeed in the work world. Thirty representatives of education, business, labor, and state government and were "charged with defining a common core of skills that constitute job readiness in the current economic environment." Specifically, the Commission was asked to:

- Define the skills needed for employment;
- Propose acceptable levels of proficiency;
- Suggest effective ways to assess proficiency; and
- Develop a dissemination strategy for the nation's schools, businesses, and homes.

The Commission met with a broad representation from business, industry and labor and produced a report, entitled "What Work Requires of Schools." The report identifies 36 workplace skills "that high-performance workplaces require and that high-performance schools– including high schools and colleges– should produce."

The Commission believes the most effective way of learning skills is "in context" –teaching learning objectives within a real environment– and that the SCANS foundation and competencies be taught and understood in an integrated fashion that reflects the workplace contexts in which they are applied.

Note: Each ARM Rotational Molding Process Technician course outline defines relevant SCANS skills in the section entitled "Integration of Academic and Workplace Skills." These SCANS skills should be integrated into lessons/activities designed to teach course objectives.

UNITED STATES DEPARTMENT OF LABOR
SECRETARY'S COMMISSION ON ACHIEVING NECESSARY SKILLS
Foundation Skills

✔ Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.

A. *Reading* - locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.

B. *Writing*- communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.

C. *Arithmetic/Mathematics* - performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques.

D. *Listening*- receives, attends to, interprets, and responds to verbal messages and other cues.

E. *Speaking* - organizes ideas and communicates orally.

✔ Thinking Skills: thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons.

A. *Creative Thinking* - generates new ideas.

B. *Decision Making* - specific goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative.

C. *Problem Solving* - recognizes problems and devises and implements plan of action.

D. *Seeing Things in the Minds Eye* - organizes and processes symbols, pictures, objects, and other information.

E. *Knowing How to Learn* - uses efficient learning techniques to acquire and apply new knowledge and skills.

F. *Reasoning* - discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.

✔ Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, integrity and honesty.

A. *Responsibility* - exerts a high level of effort and perseveres towards goal attainment.

B. *Self-Esteem* - believes in own self-worth and maintains a positive view of self.

C. *Sociability* - demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings.

D. *Self Management* - assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.

E. *Integrity/Honesty* - chooses ethical courses of action.

UNITED STATES DEPARTMENT OF LABOR
SECRETARY'S COMMISSION ON ACHIEVING NECESSARY SKILLS
Workplace Competencies

✔ Resources: Identifies, organizes, plans, and allocates resources.

A. *Time* - selects goal- relevant activities, ranks them, allocates time, and prepares and follows schedules.

B. *Money* - uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives.

C. *Materials and Facilities* - acquires, stores, allocates and uses materials or space efficiently.

D. *Human Resources* - assesses skills and distributes work accordingly, evaluates performance and provides feedback.

✔ Interpersonal: Works with others.

A. *Participates as a Member of a Team* - contributes to group effort.

B. *Teaches Others New Skills.*

C. *Serves Clients/Customers* - works to satisfy customer's expectations.

D. *Exercises Leadership* - communicates ideas to justify position, persuade and convince others, responsibly challenges existing procedures and policies.

E. *Negotiates* - works toward agreements involving exchange of resources, resolves divergent interests.

F. *Works with Diversity* - works will with men and women from diverse backgrounds.

✔ Information: Acquires and uses information.

A. *Acquires and evaluates Information*

B. *Organizes and Maintains Information*

C. *Interprets and Communicates Information*

D. *Uses Computers to Process Information*

✔ Systems: Understands complex inter-relationships.

A. *Understands Systems* - knows how social, organizational, and technological systems work, and operates effectively with them.

B. *Monitors and Corrects Performance* - distinguishes trends, predicts impacts on system operations, diagnoses systems' performance and corrects malfunctions.

C. *Improves or Designs Systems* - suggests modifications to existing systems and develops new or alternative systems to improve performance.

✔ Technology: Works with a variety of technologies.

A. *Selects Technology* - chooses procedures, tools or equipment including computers and related technologies.

B. *Applies Technology to Tasks* - understands overall intent and proper procedures for setup and operation of equipment.

C. *Maintains and Troubleshoots Equipment* - prevents, identifies, or solves problems with equipment, including, computers and other technologies.

Source: *What Work Requires of Schools*, A SCANS Report for America 2000, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210

Association of Rotational Molders

Rotational Molding Process Technician

Instructional Program Package

Addendum
National Voluntary Skill Standards
for Advanced High Performance Manufacturing

National Voluntary Skill Standards for Advanced High Performance Manufacturing

A project conducted by
NACFAM
National Coalition for Advanced Manufacturing
in conjunction with
The U.S. Departments of Labor and Education
1997

What manufacturing workers need to know and be able to do.

The following skill and knowledge statements and standards represent what NACFAM has determined to be important to manufacturing firms. The list was compiled from input given by high-performance manufacturing workers, industry leaders and educators, and represents the skills and knowledge that industry needs of its workforce. Possession of these skills will make it possible for an individual to be very successful in a variety of manufacturing occupations. Each of the skill statements should be read as a completion of the statement; " A good, competent, skilled worker can..." Each of the skill standards represents an expansion of the skill statement to include the condition, context, criteria, and forms of documentation as deemed appropriate by those providing input to the project.

What is a skill standard?

A statement that specifies the level of knowledge and competency required to successfully perform work related functions.

Note: The following represents the entire listing of skills identified by NACFAM. Skills marked with a ✔ indicate those that directly relate to, and support the ARM Rotational Molding Process Technician program package. Skills marked with a ✔★ indicate those deemed critical to successful program outcomes. It is recommended that instructors incorporate designated skills when developing lessons/activities.

Communications and Teamwork

CT 1 Skill	Identify interpersonal characteristics of a team player.
Skill Standard ✔	The individual will identify the interpersonal characteristics of a team player, listing 10 characteristics of a team player with 100% accuracy. To be determined by third party observation of a written skills activity.
CT 2 Skill	Demonstrate the characteristics of a team player.
Skill Standard ✔	The individual will demonstrate the characteristics of a team player, displaying 10 characteristics over a reasonable period of time in an ongoing evaluation. To be documented by third party observation.
CT 3 Skill	Contrast the role of a team with the role of an individual.
Skill Standard ✔	The individual will contrast the role of a team with the role of an individual , by listing 10 characteristics of a team player that contrasts with those of the individuals, within thirty minutes with 100% accuracy. To be determined by third party observation, or written performance.
CT 4 Skill	Perform techniques used as a team leader.
Skill Standard ✔	In a team environment, identify techniques used by a team leader and demonstrate them.
CT 5 Skill	Demonstrate productive relationships with the work group.
Skill Standards ✔	Demonstrate positive participation in group activities by receiving confirmation from other group members that the participation has been productive and without conflict.
CT 6 Skill	Apply group dynamic principles to manufacturing situations.
Skill Standards ✔	Functioning as a group leader, and applying positive group dynamics, develop a plan for improving a simple manufacturing process.
CT 7 Skill	Identify possible electronic communication uses.
Skill Standard	In either written or oral form, provide at least three situations where electronic communication such as e-mail would be an advantage.

CT 8 Skill	Explain the effect of electronic communication versus other communication methods.
Skill Standard	Explain the effect of electronic communication versus other communication methods. The explanation shoula be provided orally and include at least three specific comparisons and a recommendation of the best method for three different situations.
CT 9 Skill	Select appropriate communication methods.
Skill Standards ✔★	The individual or team will select appropriate communication methods, convey the message via the chosen method and achieve 100% accuracy in the third party understanding the message. To be documented by third party observation and comprehension of the intended message.
CT 10 Skill	List characteristics of a good group leader.
Skill Standards ✔	Working alone or in a group, an individual must identify and demonstrate through role play, 6 of the 8 desired characteristics that an individual must possess in order to be a good group leader.
CT 11 Skill	Identify various group processes.
Skill Standard ✔	After having participated in workplace specific teamwork training, select from a list of at least 6 appropriate processes for a group.
CT 12 Skill	Identify components of group dynamics.
Skill Standard ✔	After having participated in a workplace specific teamwork training activity, provide a list of at least 5 important skills and processes that lead to successful and productive teamwork.
CT 13 Skill	Demonstrate group leadership.
Skill Standard ✔★	In order for an individual to effectively manage and lead meetings in a team environment, the individual must be able to demonstrate group leadership skills. These leadership skills include preparing a meeting agenda, planning/organization, keeping the meeting focused and on track, delegation of tasks and responsibilities, encouraging participation, time management, providing positive

feedback and group facilitation. the individual will conduct a meeting demonstrating 5 if the 8 group leadership skills.

CT 14 Skill — Apply facilitation skills in a group setting.

Skill Standard ✔ — In a manufacturing or learning environment, receive positive affirmation from other group members and/or instructor that at least 4 specific facilitation techniques were correctly and productively applied.

CT 15 Skill — Read process information and follow instructions.

Skill Standard ✔★ — Demonstrate the ability to read a 50-word description of a three-step assembly process, and the ability to follow the instructions so that the assembly is completed according to the instructions.

CT 16 Skill — Read material and describe concepts.

Skill Standard — The individual must be able to read, interpret and summarize in writing the fundamental concept contained within each paragraph of reading material with 100% accuracy.

CT 17 Skill — Read documentation, such as a computer manual, to determine actions for specific situations.

Skill Standard ✔★ — Demonstrate the ability to read documentation, such as a computer manual, to determine actions for specific situations. This could be demonstrated by finding the instructions in a provided manual about underlining selected text and properly perform underling activity.

CT 18 Skill — Write the steps of a manufacturing process using sentences and statements as are appropriate.

Skill Standard ✔ — Working as a member of a team, write out in complete sentences with pen and paper or on the computer, the steps involved in a specific area of the manufacturing process, with 100% accuracy, in order to demonstrate the ability to identify, in writing, the sequence of and interconnectivity between the steps in the process. This would be done correctly if three other people not previously with the process were able to perform it correctly.

CT 19 Skill — Use correct punctuation.

Skill Standard	Working alone, use correct punctuation, such as commas to separate thoughts, apostrophes to show possession, exclamation points to show emphasis, semicolons and colons to separate phrases, with 100 % accuracy; in order to illustrate a standard interpretation of what is intended. To be documented by an employer, instructor, or team member.
CT 20 Skill	Use correct spelling,
Skill Standard	Working alone, use correct spelling with 100% accuracy, in order to demonstrate proficiency in writing clear and understandable written communications. To be documented by an employer, instructor, or team member.
CT 21 Skill	Write with accuracy, brevity and clarity.
Skill Standard	The individual will write with accuracy, brevity and clarity three documents and deliver those documents to a third party, and the messages are understood with 100% accuracy. To be documented by third party receiving and understanding the documents.
✔	
CT 22 Skill	Organize material with a logical flow.
Skill Standard	Demonstrate the ability to organize a series of 5 steps in a given process into the proper logical order such that the process is logical for a manufacturing assembly process.
✔★	
CT 23 Skill	Organize and deliver a persuasive oral presentation.
Skill Standard	The individual or team will organize the appropriate resources or research necessary to deliver a persuasive oral presentation, in order to illustrate the importance of oral communication in solving problem or making decisions. The presentation will be evaluated by a third party.
CT 24 Skill	Demonstrate good speaking characteristics.
Skill Standard	The individual will demonstrate good speaking characteristics in to converse in a professional and socially acceptable manner. Individuals will show appropriate use of grammar, context and style in a 10-20 minute business conversation and evaluated by the second party.

CT 25 Skill	Demonstrate appropriate presentation demeanor.
Skill Standard	The individual or team will demonstrate appropriate skills and techniques necessary to deliver a business presentation, in order to illustrate the importance of oral communications in problem solving, decision making or sharing of information. The presentation will be evaluated by a third party. Examples of appropriate demeanor include dress, voice, eye contact, organization, gestures etc.
CT 26 Skill	Interpret and clarify directions prepared by others.
Skill Standard ✔	The individual or team will interpret and clarify directions prepared by others . Given three sets of direction, the individual or team will perform the specified tasks within a reasonable time frame with 100% accuracy. To be documentea by third party observation of the skills performance.
CT 27 Skill	Communicate with customer to establish requirements.
Skill Standard ✔	The individual will communicate with the customer to establish requirements. Given 2 role-plays or actual situations, the individual will identify those needs and fully satisfy the customer with 100% accuracy. To be documented by third party observation of the skills performance.

Math and Measurement

MM 1 Skill	Add, subtract, multiply and divide four digit numbers with the use of a calculator.
Skill Standard ✔	Working alone with a calculator, add 10 three or four digit numbers five times in three minutes with 100% accuracy, in order to perform necessary calculations for SPC (Statistical Process Control) during the manufacturing process. To be determined by third party or performance assessment.
MM 2 Skill	Add, subtract, multiply and divide four digit numbers without the use of a calculator.
Skill Standard ✔	Working alone without a calculator, add 10 three or four digit numbers five times in three minutes with 100% accuracy , in order to perform necessary calculations for SPC during the manufacturing process. To be documented by third party or performance assessment.

MM 3 Skill	Apply basic math function to solve problems .
Skill Standard	Given a common manufacturing situation such as the need to calculate the total cost of an assembly and the cost of each of several component parts, demonstrate the use of basic math functions to compute the answer.
✔	
MM 4 Skill	Create and interpret basic graphs and charts commonly used in manufacturing.
Skill Standard	Demonstrate the ability to describe the meaning and importance of each of 5 common charts used in manufacturing such as those showing SPC data, customer satisfaction, number of lost time accidents, percentage of products meeting quality requirements, and number of inventory items.
✔	
MM 5 Skill	Match measurement activities to manufacturing process.
Skill Standard	Given 3 common manufacturing situations requiring the measurement of component or assembled parts, select the proper measuring device such as micrometer, vernier caliper, steel tape or rule, thread gage.
✔	
MM 6 Skill	Select and use appropriate measurement techniques and instruments.
Skill Standard	Complete MM5 and then demonstrate the use of the various measurement devices according to commonly accepted industry standards and/or instructions for proper use provided by the manufacturer of the measuring device.
✔★	
MM 7 Skill	Describe measurements' role in manufacturing.
Skill Standard	Provide a 200-word description of the importance of measurement in manufacturing. Should include reference to fit, function and customer requirements.
MM 8 Skill	Distinguish between direct and calculated measurements.
Skill Standard	Given appropriate part prints, show which measurements may be made or used that are directly applied to the part, and those which are or must be calculated by adding component dimensions. Ideally this would also include a description of the potential error introduced by doing " chain " measurements.
✔	

MM 9 Skill	Compute calculated measurements.
Skill Standard ✔	Demonstrate the ability to add and subtract both inch-fraction and metric measurement as they might be derived from a typical manufacturing part print or process description.
MM 10 Skill	Demonstrate proper general measurement techniques.
Skill Standard ✔	Demonstrate the proper use of common measuring devices used in manufacturing such as micrometer, vernier caliper, depth gage, steel rules, and thread gage.
MM 11 Skill	Demonstrate proper precision measurement techniques.
Skill Standard ✔	See MM 10.
MM 12 Skill	Describe the appropriate application and use of precision measurement in manufacturing.
Skill Standard ✔	Complete MM 10 and then provide a description identifying the proper and appropriate use of each of the devices.
MM 13 Skill	Explain calibration requirements of various precision instruments.
Skill Standard ✔	After having participated in a training session about the use and calibration of a specific precision instrument , provide an oral explanation of the importance to calibrate the instrument and the frequency with which it should be home. The description should essentially match the recommendations of the manufacture.
MM 14 Skill	Illustrate measurement differences when taken with calibrated and non-calibrated instruments.
Skill Standard	See MM 13
MM 15 Skill	Match appropriate measurement tools with various types of measurement requirements.
Skill Standard ✔	Working alone, the individual will recognize and specify the necessary measuring tools for a given application. This skill will be evaluated within the context of the appropriate manufacturing environment.

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MM 16 Skill
Skill Standard
✔★

Demonstrate proper measurement tool usage.
Working alone, the individual must demonstrate proper storage, retrieval, calibration and use of common tools in a manufacturing environment. Examples include ruler, micrometer, vernier caliper, plug gages.

MM 17 Skill
Skill Standard
✔

State selection criteria for measurement tools.
Given 4 common measuring tools used in manufacturing, identify the measuring situation in which each would be used. Then provide a description of the proper selection of a proper measuring device given a specific need for taking an accurate measurement.

MM 18 Skill
Skill Standard
✔★

Convert between US and metric measurement systems.
Working alone with a calculator, a metric to English conversion chart, and a part print, convert ten measurements on the print from metric to English or English to metric with 100% accuracy in five minutes.

MM 19 Skill
Skill Standard
✔

Convert fractional measurements to decimal measurements.
Many manufacturing situations require that individual workers be able to convert measurements from fractional form to decimal form. A competent worker must be able to perform this conversion accurately by using a table or other reference material. Proper performance would include knowledge of location of conversion table and ability to use table.

MM 20 Skill
Skill Standard
✔

Compute within measurement systems.
Demonstrate the ability to add, and subtract whole fractions, and decimal numbers in both English and metric systems. This would be shown by completing 10 calculations in 5 minutes with 100% accuracy.

MM 21 Skill

Removed during validation

MM 22 Skill
Skill Standard
✔

Interpret results of measurements and calculations.
Demonstrate the ability to describe the results of a series of measurements on a typical manufactured part. This should include whether or not the part meets stated specifications, and the amount of variance. This description should be done both in writing and orally

and should be approximately 100 words. Successfully done, the person to whom the description is given should be able to repeat it to another person such that the third person can clearly and accurately describe part variation.

MM 23 Skill — Removed during validation

MM 24 Skill — Distinguish between general and precision measurement.
Skill Standard ✔ — Accurately select from a list of 15 examples, those practices or situations that are classified as either general or precision measurement activities.

MM 25 Skill — Distinguish between US and metric measurement systems.
Skill Standard ✔ — A person working in manufacturing may be faced with either US or metric measurements, either at different companies or in the same company. Therefore, a person must be able to distinguish between US and metric systems. This would be demonstrated in a structured learning experience, or on a previous job. This should be done with complete accuracy.

Workplace safety and Health

WH 1 Skill — Assume responsibility for the personal safety of self and others.
Skill Standard ✔ — In a situation with health or safety risks, a person with this skill will take and implement all appropriate personal safety precautions such as hard hats, eye protection, protective clothing or protective footwear. A fully competent worker will also insist that other co-workers take similar precautions. Being able to explain to others the reasons for safety including personal protection and the effect on company finances and health care costs are essential.

WH 2 Skill — Maintain a clean and safe work environment.
Skill Standard ✔ — In order to protect personal safety and maximize productivity, it is important to maintain a clean and safe work environment. A person could demonstrate this skill in a work environment, in an avocational endeavor, or in a training learning situation. Proper demonstration of this skill could be documented be a co- worker, supervisor, instructor/trainer, or self.

WH 3 Skill	Demonstrate a positive personal attitude towards safety.
Skill Standard	In order to fit in successfully in a high performance workplace where personal safety is an essential part of workplace practice, a good worker must demonstrate a positive personal attitude towards safety of self and company property. This means the person would always practice proper safety and would react with positive comments, tone of voice, and body language as part of any discussion on safety issues or practices.
✔	
WH 4 Skill	Comply with established safety practices.
Skill Standard	The individual or team will comply with established safety practices, 100% of the time on a ongoing basis. To be documented by written tests and third party observations.
✔★	
WH 5 Skill	Complete forms/paperwork as required.
Skill Standard	It is important to the operation of a company that required forms and paperwork are completed on time and contain all requested information . The information should be spelled correctly and be legible. The skill could be documented from previous work experience or a structured learning experience.
✔★	
WH 6 Skill	Wear protective clothing as required.
Skill Standard	Individual should demonstrate proper selection and use of protective safety clothing appropriate to the manufacturing environment.
✔	
WH 7 Skill	Maintain and use protective guards and equipment and machinery.
Skill Standard	The individual or team will maintain and use industry or company specified protective guards on equipment and machinery, performing all specified procedures prior to equipment operation with 100% accuracy. To be documented with a checklist by third party observation.
✔★	
WH 8 Skill	Handle/store flammable (hazardous) materials appropriately.
Skill Standard	The individual will handle and or store flammable (hazardous) material appropriately, correctly handling and storing five flammable materials with 100% accuracy. To be documented by third party observation.
✔	

WH 9 Skill	Use electrical devices correctly and safely.
Skill Standard	Identify electrical devices and state how incorrect use can be hazardous.
✔	
WH 10 Skill	Prevent spontaneous ignition by practicing proper waste disposal habits.
Skill Standard	Identify the factors that could lead to spontaneous ignition of waste and corrective measures to prevent this occurrence.
WH 11 Skill	Keep marked aisles clear of equipment and materials.
Skill Standard	Describe what a marked aisle looks like and state why it has to be clear of equipment and materials.
✔	
WH 12 Skill	Interpret/display MSDS as required.
Skill Standard	Locate the MSDS and explain their purpose and how to use them for a specific material commonly used on the factory floor.
✔★	
WH 13 Skill	Identify fire exits and fire-fighting equipment.
Skill Standard	Locate closest fire exit and identify various pieces of fire-fighting equipment including alarms.
✔	
WH 14 Skill	Report unsafe practices to appropriate personnel.
Skill Standard	The individual or team will identify and report all unsafe practices to appropriate personnel based on OSHA and or company policies. To be documented by third party observations.
✔	
WH 15 Skill	Operate equipment in a safe, prescribed manner.
Skill Standard	The team or individual will operate equipment in a safe prescribed manner, completing the prescribed equipment function within established safety guidelines. To be documented by certification or third party observation.
✔	
WH 16 Skill	Locate power shutoff controls for all machinery/equipment.
Skill Standard	The individual will locate power shutoff controls for all machinery/equipment, with appropriate speed for personal and co-worker safety, with 100% accuracy. To be documented by third party observation.
✔	

WH 17 Skill	Report malfunctions to appropriate personnel.
Skill Standard	See MF 7
WH 18 Skill	Inspect material/equipment/fixtures for defects.
Skill Standard ✔	The individual and /or team will inspect and identify materials, equipment or fixtures for defects, given 2 problems in each specific area, with 100 % accuracy. To be documented by third party observation.
WH 19 Skill	Determine weight/operating limits of equipment.
Skill Standard ✔	The individual will determine weight/operating limits of equipment, utilizing three pieces of equipment, within 5 minutes per function, with 100% accuracy. To be documented by third party observation.
WH 20 Skill	Perform periodic checks during operation to assure proper function.
Skill Standard ✔	The individual or team will perform periodic checks during operation to assure proper function. Three checks will be performed with 100% accuracy in an appropriate time to insure safety. To be documented by third party observation.
WH 21 Skill	Possess valid first aid card.
Skill Standard	An individual will possess a valid first aid card at all times while at work, completing the safety course for initial card and then completing all refresher courses necessary to maintain certification. As documented by a second party acknowledging that the card is valid.
WH 22 Skill	Determine need for CPR and administer as appropriate.
Skill Standard	Individual will recognize the symptoms of heart failure and be able to respond appropriately . A written exam identifying the symptoms involved in the administration of CPR will be augmented by a demonstration of the procedures. As documented as pass/ fail by second party assessment of written exam and demonstration.
WH 23 Skill	Apply appropriate first aid techniques.
Skill Standard	On an individual basis, respond appropriately to a workplace emergency and apply appropriate first aid procedures.

WH 24 Skill Skill Standard ✔	Define different types of chemical, biological, and physical hazards. Given a defined workplace environment, the individual will recognize all general and specific workplace hazards. This may include: materials and chemicals used to complete the manufacturing processes, germs, bacteria, viruses, and other contagious microorganisms, as well as, noise, fumes, obstructions, unsafe equipment and procedures. The individual will perform a safety check (checklist) in a manufacturing environment in which he/she has been trained to work. A second party will document by reviewing the checklist during a walk-through with the individual.
WH 25 Skill Skill Standard ✔	Respond to emergencies in the appropriate manner. An individual must have knowledge of standard emergency procedures, including phone numbers, emergency call boxes, personnel to be contacted, emergency equipment to use, power and utility lock-out, severe weather, fire, flood, and wind damage. Above must be performed in accordance with company standard operating procedures, as documented in training session performance and written/oral exam by a second party.
WH 26 Skill Skill Standard ✔	Describe ergonomics and its importance to the manufacturing process. Individual/team will describe the potential physical hazards employees are exposed to in their normal work environment. These will include: body position, repetitive motions, weight manipulation, lighting, eye strain. Creative solutions to these problems will be implemented in an economical and efficient manner. Second party will document proper understanding of these principals through written/oral exam.

Problem Solving

PS 1 Skill Skill Standard ✔	Explain the value of applying a problem solving system. The individual will be able to explain how using a defined problem solving system can improve a situation or process and benefit organizations.
PS 2 Skill	Apply a system of problem solving .

Skill Standard ✔	Working alone or in a group, the individual will be able to list and describe the steps of a problem solving method, and use the appropriate "tools" to solve an identified problem.
PS 3 Skill Skill Standard ✔	Identify opportunities for applying problem solving techniques. Working alone or in a group, the individual will be able to identify and select problem(s) that present an opportunity for improvement in a given process.

Quality Assurance

QA 1 Skill	Contrast quality manufacturing system with other manufacturing systems.
Skill Standard	Working as part of a group, develop a 200 word description explaining the differences and advantages of a manufacturing system focused on quality (meeting customer expectations) with one that is not. Include the impact on profits and business reputation.
QA 2 Skill	Identify influences of a quality system on specific manufacturing processes.
Skill Standard	After having participated in a learning experience about a manufacturing situation not focused on quality, provide an oral description of several changes that could be made to move the process towards a quality system that will meet customer expectations, and result in most favorable cost, and delivery measures.
QA 3 Skill Skill Standard ✔	Explain the effect of quality on profit. In today's manufacturing environment, it is essential to build quality products in order to make a profit which is necessary for continued operation. Quality is described as meeting customers expectations, and only if customer expectations are met can the company's product be sold and a profit produced. It is critical that an employee in a company knows and can articulate this concept in order to participate in company discussions about quality, customer satisfaction and quality.
QA 4 Skill	Identify the effects of continuous quality improvement.

Skill Standard ✔	Given a list of possible outcomes, both positive and negative, a competent employee will correctly select 5 major positive outcomes resulting from a business employing continuous quality improvement practices.
QA 5 Skill	Demonstrate the ability to apply continuous quality improvement to the manufacturing process.
Skill Standard ✔	Working as part of a team, demonstrate the ability to participate and contribute to a continuous improvement activity. This would include diagraming current process, setting improvement goals, and clarifying process and purpose, brainstorming and reaching consensus, prototyping changes, collecting data, and standardizing improvements with beneficial results and documenting improved process.
QA 6 Skill	Integrate improvement processes.
Skill Standard ✔	In a work situation, demonstrate the integration of process improvement activities and document success by showing improved process and output data. To be documented by co-workers, or process owners.
QA 7 Skill	Define SPC
Skill Standard ✔	The individual will define SPC, within 4 minutes, list 5 major components of SPC with 100% accuracy. To be documented by third party observation or written test like activity.
QA 8 Skill	Identify the relationship between SPC steps and specific production processes.
Skill Standard ✔	After receiving an explanation of a typical manufacturing process, identify the steps or situations that are appropriate for the application of SPC practices and what the potential benefits might be.
QA 9 Skill	Apply SPC to specific production processes.
Skill Standard ✔	After having participated in a company specific learning activity, demonstrate the ability to accurately complete the steps necessary to complete the SPC according to the company standard.

QA 10 Skill
Skill Standard
✔

Analyze production specific processes.
After having been presented with various SPC data, provide a 100 word oral analysis of the situation about whether the process is conforming, and capable. Then provide a 50 word oral description of what steps might be taken to bring the process into conformity.

QA 11 Skill
Skill Standard
✔

Analyze and interpret test data for compliance to specifications.
After having been presented with various SPC data, provide a 100 word analysis of the situation about whether the process is conforming, and capable. Then provide a 50 word oral description of what steps might be taken to bring the process into conformity.

QA 12 Skill
Skill Standard
✔

Improve production process (if indicated by analysis of data).
After having been presented with various SPC data, provide a 100 word oral analysis of the situation about whether the process is conforming, and capable. Then provide a 50 word oral description of what steps might be taken to bring the process into conformity.

QA 13 Skill
Skill Standard
✔

Maintain production according to instructions.
While participating in a simulated or real manufacturing process, demonstrate the ability to collect data, interpret results, and make adjustments to bring the process within spec and maintain that situation.

QA 14 Skill
Skill Standard
✔

Identify customer problems.
As part of normal manufacturing responsibilities, it is important to be able to identify customer problems. Information will be presented either as part of customer response data or individual conversations. Customer problems must be identified and extracted from the data/information or conversation. This would be demonstrated either through previous successful workplace experience or simulations in a learning activity. The proper performance of the skill and application of knowledge would be determined either through observation; comparison to correct responses in the simulation, or best would be to determine accurate identification by getting concurrence from actual customers.

QA 15 Skill	Classify customer problems.
Skill Standard ✔	Identify potential customer complaints (customer service, product, price, shipping, time to market, marketing) and go to the appropriate source to handle complaints.
QA 16 Skill	Determine causes of the problem.
Skill Standard ✔★	Given a customer problem (e.g. malfunctioning product), identify what happened to bring about this problem (e.g. missing a key component).
QA 17 Skill	Apply problem-solving system.
Skill Standard ✔★	Working as part of a group in learning situation, demonstrate the ability to apply a specific learned set of steps to solve or improve a manufacturing situation related either to a manufacturing process or a customer complaint. Include, identify and quantify the problem, look for root causes, develop a correction plan, implement plan, observe results and compare to plan, consult with customer.
QA 18 Skill	Recommend possible solutions.
Skill Standard ✔	Working as part of a group in learning situation, demonstrate the ability to apply a specific learned set of steps to solve or improve a manufacturing situation related either to a manufacturing process or a customer complaint. Include, identify and quantify the problem,. look for root causes, develop a correction plan, implement plan, observe results and compare to pian, consult with customer.
QA 19 Skill	Develop a plan utilizing a selected quality control system.
Skill Standard ✔	Working as part of a group in learning situation, demonstrate the ability to apply a specific learned set of steps to solve or improve a manufacturing situation related either to a manufacturing process or a customer complaint. Include, identify and quantify the problem, look for root causes, develop a correction plan, implement plan, observe results and compare to plan, consult with customer.
QA 20 Skill	Evaluate process selected versus desire goals.
Skill Standard ✔	Working as part of a group in learning situation, demonstrate the ability to apply a specific learned set of steps to solve or improve a

manufacturing situation related either to a manufacturing process or a customer complaint. Include, identify and quantify the problem,. look for root causes, develop a correction plan, implement plan, observe results and compare to plan, consult with customer.

Blueprint Readings

BR 1 Skill	Define basic blueprint terminology.
Skill Standard ✔	The individual will define basic blueprint terminology such as title block, border, views, notes, revision blocks, etc. In addition the individual will recognize the intent of the drawing and its use in manufacturing.
BR 2 Skill	Identify different dimension methodologies.
Skill Standard ✔	The individual will differentiate between dimensions of location and size. These dimensions may be represented as ordinate, base line, tabular, etc.
BR 3 Skill	Identify general note symbols.
Skill standard ✔	The individual will identify general note symbols and their applications within a manufacturing environment. Examples of symbols include finishing requirements, material specification, machining/manufacturing specifications, assembly symbols, ANSI symbols, etc.
BR 4 Skill	Locate notes on print.
Skill Standard ✔	The individual will locate notes on a print using industry standards, using three drawings with 2 minutes per note and 100% accuracy.
BR 5 Skill	Interpret commonly used abbreviation and terminology.
Skill Standard ✔	The individual will interpret commonly used abbreviation and terminology used on prints in the manufacturing environment, using 3 drawings with 5 abbreviations or terms each with 100 % accuracy and a limit of 2 minutes per term/abbreviation.

BR 6 Skill	Determine tolerances associated with dimensions on a drawing.
Skill Standard	All dimensions on a blueprint have either a specific or an implied tolerance. Given a drawing, the individual must distinguish the tolerance that applies to a specific dimension.
✔	
BR 7 Skill	Removed during validation.
BR 8 Skill	Identify types of lines within a drawing.
Skill Standard	Working alone, identify the representation of the various lines found on a drawing. Examples include hidden lines, object lines, extension lines, section lines. Individuals should read various drawings and identify lines with 100% accuracy.
✔	
BR 9 Skill	List the essential components found in the title block.
Skill Standard	Individually, the participant should interpret the following information from a blueprint title block: company name, part name and number, material, name of designer and checker, revision history, and other important information regarding the part.
BR 10 Skill	List the essential components found in the revision block.
Skill Standard	Recognize the changes the design has progressed through from the original design. Interpret the meaning of revision block symbols and notations. Match the revision block components with the actual drawing features.
BR 11 Skill	Identify the orthographic views.
Skill Standard	Recognize the three basic views which may be represented on the drawing; front, top and right side. Identify if the print is drawn in first or third angle projection. Detect features represented in one view and find those same features in another view.
BR 12 Skill	Identify isometric views.
Skill Standard	On a drawing containing orthographic and isometric, properly identify the isometric view. Provide a 50-word description of what constitutes an isometric view and its relation to orthographic views.
✔★	

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BR 13 Skill	Identify positions of views: top, front, side, auxiliary, section.
Skill Standard ✔★	Given an orthographic drawing, identify all appropriate views according to their position or placement on print. Or, given an actual part, the individual will be able to match the views tho the appropriate surfaces.
BR 14 Skill	Visualize one or more views from a given isometric or pictorial representation of an object, or from the actual object.
Skill Standard ✔★	See BR 10-13
BR 15 Skill	Determine the scale of the view or section.
Skill Standard ✔	Based on the title block information, physical scaling of view, and standard drawing scale, determine appropriate scale of view or section.
BR 16 Skill	Check for revisions.
Skill Standard ✔	Given a series of drawings, some of which contain revisions and proper notation, properly identify which ones are the most current revisions, and identify which drawings do not contain revisions.

Manufacturing Fundamentals

MF 1 Skill	Perform basic arithmetic functions.
Skill Standard ✔	Working alone with calculator, the individual will be able to perform basic mathematical operations (addition, subtraction, multiplication and division); convert from one form to another using whole numbers, fractions, decimals, percentages. 10 problems to be completed for each mathematical operation within a time frame of 30 minutes with 100% accuracy.
MF 2 Skill	Use measuring instruments.
Skill Standard ✔	Working alone using basic measuring instruments the individual will demonstrate proficiency by taking 5 specified measurements for each part and recording results within an acceptable variation.

MF 3 Skill	Use hand calculators.
Skill Standard ✔	The individual will use hand calculators to demonstrate basic arithmetic function, performing 10 arithmetic calculations, 2 minutes per calculation with 100% accuracy. To be documented by a written performance activity.
MF 4 Skill	Calculate with percents, rate, ratio and proportion with the use of a calculator.
Skill Standard ✔	The individual will calculate percents, rate, ratios, and proportions with the use of a calculator, performing 2 problems per function, with a 3 minute limit per problem with 100% accuracy. To be documented by written activity.
MF 5 Skill	Make reasonable estimates of arithmetic results without the use of a calculator.
Skill Standard ✔	The individual will make reasonable estimates of arithmetic results without the use of a calculator, performing 10 problems, 1 minute per problem, with accuracy based on predetermined limits. To be documented by a written performance activity.
MF 6 Skill	Demonstrate basic mechanical skills.
Skill Standard ✔★	The individual or team will demonstrate basic mechanical skills, using proper safety techniques, efficient methodology performing all mechanical skills in reference to their established job tasks. To be documented by third party observation.
MF 7 Skill	Identify and report equipment malfunctions.
Skill standard ✔	The individual or team will identify and report equipment malfunctions, following predetermined procedure, putting safety first and observed by a third party for documentation.
MF 8 Skill	Follow established safety procedures when around machinery/equipment.
Skill Standard ✔	Given a piece of machinery or equipment, identify the proper safety procedures and follow them.

MF 9 Skill

Describe the importance of correct fixturing and work holding devices.

Skill Standard

✔★

Provide a 50-word description including 5 specific reasons for using proper work holding and fixturing devices. Included should be mention of product, equipment, and personal safety, as well as accuracy.

MF 10 Skill

Follow established safety procedures when using machine tools.

Skill Standard

✔

Individual will practice safety procedures (100% of the time) that have been established by the company in regard to using any or all machine tools, with documentation by a second party observation conducted periodically throughout the workday for at least 10 minutes.

MF 11 Skill

Identify a variety of common machine tools.

Skill Standard

✔

Individual will identify the common machine tools used within the manufacturing environment with 100% accuracy as assessed by a second party oral exam, naming the tool and asking the individual to select that tool from an assortment of tools.

MF 12 Skill

Describe the function of specific machine tools.

Skill Standard

✔

The individual will describe the function of each and every machine tool being used in that manufacturing environment, with 100% accuracy, including tool room, production machinery, special machines; with documentation by a second party oral exam.

MF 13 Skill

Inspect machine tools for defects.

Skill Standard

✔

The individual will inspect tools for defects, with 100% accuracy, in order to maintain tools and equipment on top working condition, as documented by a second party observation of the inspection. This would include being free of defects such as abnormal noise, leakage's of fluids, broken or damaged accessories, frayed electrical cords, missing safety devices.

MF 14 Skill

Maintain company provide machine tools.

Skill Standard

✔

An individual will be aware of maintenance logs and schedules and can specify the necessary maintenance procedure to keep the machine tools in good operating condition, as measured by participating as a team member in the decision-making process.

MF 15 Skill	Locate and retrieve production materials specific to process flow and deliver schedule.
Skill Standard ✔	The individual or team will locate and retrieve production materials specific to process flow and delivery schedule; within a given manufacturing process with 100% accuracy. To be documented by third party observation or written task sheets.
MF 16 Skill	Receive and communicate process flow instructions and delivery schedules.
Skill Standard ✔	Demonstrate the ability to receive and then communicate to others process flow instruction and delivery schedules.
MF 17 Skill	Operate hand tools in a safe prescribed manner.
Skill Standard ✔	The individual will demonstrate the proper and safe hand tool operation with all company provided hand tools, following correct procedure in regard to personal and co-worker safety. To be documented by third party observation.
MF 18 Skill	Inspect hand tools for defects.
Skill Standard ✔	The individual will identify defects in hand tools, identifying the 4 common defects in 3 hand tools with 100% accuracy. To be documented by third party observation.
MF 19 Skill	Maintain company provided hand tools.
Skill Standard ✔	The individual will properly identify and perform proper maintenance on all company provided hand tools to established standards. To be documented by a third party observer.
MF 20 Skill	Interpret prints to determine appropriate tool usage.
Skill Standard ✔	The individual will interpret prints to determine appropriate tool usage, using 2 different prints with various tool requirements with 100% accuracy. To be documented by a third party observer.
MF 21 Skill	Follow electrical troubleshooting procedures.
Skill Standard ✔	Demonstrate ability to follow a set of instruction for troubleshooting an electrical problem in a simple switched circuit. It would be properly completed if the problem causing non-function is properly identified.

MF 22 Skill
Skill Standard

Identify types of work saving devices used in manufacturing.
From a list of 20 examples, select the 10 that provide work-saving opportunities in a typical manufacturing situation.

MF 23 Skill
Skill Standard

Describe scenarios in which work-saving devices can be used.
Provide three 25- word scenarios describing appropriate and beneficial use of work-saving devices in a manufacturing environment. These might include tool- balancing devices, product-work positioning devices, and product
holding devices.

Business Planning and Operation

BO 1 Skill
Skill Standard
✔

Identify the organizational need for profit.
Provide a 100 to 125-word explanation of the need of an organization to generate an operating profit. The description should make reference to increasing shareholder/owner equity, potential for profit sharing and bonuses, and new business development and research.

BO 2 Skill
Skill Standard
✔

Identify opportunities for profit in manufacturing processes.
As a part of a work team seeking to continuously improve processes, an individual should be aware of possible opportunities for increasing profit in manufacturing. Therefore, a successful worker should be able to list in a conversation 6 to 10 such opportunities such as reduced assembly or handling steps, reduced use of materials, reduce the time of the process, reduced scrap, increased quality, improved alignment with customer expectation, reduced labor content, additional use of available machine time, and additional use of employee time.

BO 3 Skill
Skill Standard
✔

Identify possible barriers to profit in manufacturing processes.
Describe at least 5 things that can negatively affect a business profit. These could include scrap, re-work, lost time accidents, excess direct or overhead cost, need for after sale service, penalties for late delivery, and product failing to meet functional requirements. The description can be provided either orally or in written form by either and individual or workgroup.

BO 4 Skill	Identify strategies that may maximize profit potential in manufacturing processes.
Skill Standard ✔	Working alone or as part of a group, describe how competitive pricing , meeting and exceeding customer quality expectations and on time delivery enhance the profit potential for a company through increased orders and improved competitive prices.
BO 5 Skill	Recognize a business plan that provided for an acceptable profit.
Skill Standards	Given 2 different process (business) plans, select the one that offers the best profit potential based on direct and indirect costs, including time and materials. This should be done as part of a work group.
BO 6 Skill	Identify the components that lead to customer satisfaction.
Skill Standard ✔	Working alone list 5 factors that affect customer satisfaction including cost, quality, delivery, suitability to purpose, and product life cycle. This explanation should be approximately 75 words presented either orally or in writing and acceptable to 3 other co-workers/students.
BO 7 Skill	Identify possible actions that may lead to customer satisfaction.
Skill Standard ✔	State 3 things that an individual employee can do that will lead to increased customer satisfaction. This should include both product features and the importance of communications with the customer such as listening carefully, timely response to requests, and when possible anticipating customer needs.
BO 8 Skill	Identify the ways that the level of customer satisfaction may affect company success.
Skill Standard ✔	Provide 3 examples of relationships between cost, quality, and delivery resulting in customer satisfaction and the potential impact on company profit and success. This would best be demonstrated in a written form, but would be acceptable in a conversational form.

BO 9 Skill	Explain the importance of a business reputation.
Skill Standard	Give an oral description of approximately 150 words about the importance of the reputation of a business and its potential impact on the success of the company. Should include references to additional orders and support of pricing structures.
✔	
BO 10 Skill	Identify the ways that customer satisfaction influences a business reputation.
Skill Standard	As part of a group, develop a 150-word written description of the impact that customer satisfaction has on a business reputation and ultimately on business success and continuation.
✔	
BO 11 Skill	Identify possible actions that may be used to correct customer dissatisfaction.
Skill Standard	Create a list of 4 things that can be done to improve a situation where a customer (either internal or external) expresses dissatisfaction. This should done both orally and in written form.
BO 12 Skill	Define a safe work environment.
Skill Standard	Working alone, the individual will survey a designated work section and identify a minimum of 5 safe conditions and a minimum of 5 correctable unsafe conditions.
✔	
BO 13 Skill	Identify immediate and real costs of an accident.
Skill Standard	Provide an oral or written paragraph of approximately 100 words identifying 5 possible negative cost factors that may result from an accident that damages equipment, product or injures a worker.
✔	
BO 14 Skill	Identify methods of preventing accidents in the workplace.
Skill Standard	Identify 10 specific action or precautions that can be used to reduce the potential of accidents in the workplace. Include references to equipment maintenance, housekeeping, equipment safety devices, personal safety protection devices, and proper work procedures.
✔★	

B0 15 Skill	Define the term value-added.
Skill Standard	An individual will provide the definition of " value-added" and explain its context in terms of the manufacturing environment, as demonstrated to a second party in the form of a written definition or oral discussion.
B0 16 Skill	Identify steps within manufacturing processes that determine cost.
Skill Standard	Identify 10 items and manufacturing processes that contribute to the cost of a product. These items should be selected from a list of 20 items including both item that do and do not determine cost.
B0 17 Skill	Define the term profit.
Skill Standard ✔	An individual will provide the definition of "profit" and will explain its context in terms of the manufacturing environment, as demonstrated to a second party in the form of a written definition or oral discussion.
B0 18 Skill	List the benefits that are employer paid or provided.
Skill Standard ✔	An individual or team will list (with 100% accuracy) the benefits that are paid for or provided by the employer, such as: vacation / sick leave, funeral leave; medical, dental, optical insurance; workers compensation, and retirement or pension plans, so as to ensure that there is a clear understanding of the benefits provided. as documented by a benefits officer or other Human Resources personnel.
B0 19 Skill	List the benefits that are offered to employees for their optional participation.
Skill Standard	An individual or team will list 100% of the benefits that are available to employees for optional participation and at cost to the individual, such as: life insurance, additional medical insurance, cafeteria /401K plans, etc., to ensure that there is a clear understanding of all optional benefits. As documented by a benefits officer or other Human Resources personnel.

Computer Use

CU 1 Skill	List possible computer applications in manufacturing processes.
Skill Standard ✔	Without reference materials, list 10 applications of computers (including software and networks) that will result in improvements in the manufacturing and support process.
CU 2 Skill	Identify possible effects of introducing computers into manufacturing processes.
Skill Standard ✔	Alone or in a team, list the effects of bringing computers into the mfg. process. Should include references to schedule, cost and quality. And, should include the impact on the skill and knowledge requirements of all members of the company organization.
CU 3 Skill	List various methods of tracking inventory quantities.
Skill Standards ✔	Alone or in a team, identify the following 4 methods of tracking inventory quantities: paper and pencil, computer systems, inventory tracking cards and physical count.
CU 4 Skill	List factors that determine inventory demand.
Skill Standard	Alone or in a team, list 4 factors that affect the demands on inventory. This should be included in a 150-word written or oral description including the benefits of minimal inventory quantities, the cost of work in process, and the concepts and requirements of just-in-time delivery.
CU 5 Skill	Demonstrate use of an industry-accepted word processing software package.
Skill Standard	An individual will demonstrate proficiency in an appropriate word processing package, as illustrated by the completion of a writing sample such as a business letter, memo, or technical report. Documents will be produced in and appropriate time frame in the presence of a third party.

CU 6 Skill	Demonstrate use of an industry-accepted spreadsheet software package.
Skill Standard	An individual will demonstrate proficiency in an appropriate spreadsheet software package, as illustrated by the completion of a spreadsheet, chart or table. Document will be produced in an appropriate time frame in the presence of a third party.
CU 7 Skill	Demonstrate use of an industry-accepted database software package.
Skill Standard	An individual will demonstrate proficiency in an appropriate database software package, as illustrated by the completion of mailing lists, tables, or other appropriate charts. Document will produced in an appropriate time frame in the presence of a third party.
CU 8 Skill	Demonstrate use of an industry-accepted statistical processing software package.
Skill Standard	An individual will demonstrate proficiency in an appropriate statistical processing software package, as illustrated by the completion of appropriate charts, tables or measurements based upon given data. Document will produced in an appropriate time frame in the presence of a third party.
CU 9 Skill	Demonstrate use of an industry-accepted graphic software package.
Skill Standard	Working alone with the use of a computer and graphics software, the individual must be able to create pie, bar, hi/lo, area, and line graphics based on predetermined data values, and be able to choose the graph type that is best suited to represent the data interpretation.

Process Control and Improvement

PC 1 Skill	List a variety of process control applications.
Skill Standard ✔	The individual must identify manufacturing process variables to 100% accuracy. These must be controlled for quality and reliability. This will include controlling quality of incoming materials, amounts of materials, operator skills, adjustable parameters: time, temperature, pressure, speed, voltage, etc. Documented by review of written list.

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PC 2 Skill — Collect and analyze information to determine and improve work processes.

Skill Standard ✔ — The individual or group must identify important parameters and collect the data in a scientific fashion. Then the data will be analyzed statistically to look for trends or variability in process. The individual or group will determine the appropriate adjustments to improve the process. These skills will be assessed by a second party to determine if continuous process control is actually working.

PC 3 Skill — Explain the advantages and disadvantages of just-in-time inventory.

Skill Standard — Working as a part of a group, after participating in a company specific training activity, complete a 200-word description of the advantages of just-in-time delivery. This should include both the company as a supplier and customer, and should incluae the impact on cost and schedule parameters for both the supplier and customer.

PC 4 Skill — Create a project plan.

Skill Standard — Working as a part of a project team, complete a project and process plan such that another team can or could complete the project and sub-processes. Then after having reviewed another team's plan, produce an improved plan that improves on cost, quality, and schedule.

Workforce Issues

WI 1 Skill — Recognize the difference between a team environment workplace and a conventional workplace.

Skill Standard — In order for a person to select the type of workplace they would like to be involved in, it is important that they be able to recognize the difference between a workplace with a team environment and a workplace that is not organized with work teams This would be done by asking questions of the employer and/or current employees during a job interview or research about possible work places. This could be judged in a learning situation by presenting a learner with typical workplace scenarios and asking for the correct response.

WI 2 Skill	Explain how organization structure affects a manufacturing process.
Skill Standard	Explain in approximately 200 words how different organizational structures can affect different kinds and sizes of manufacturing processes. The explanation should reference a traditional supervisor-led organization and compared to work teams and self-directed empowered workers. Then list the affects of these different structures.
WI 3 Skill	Explain the characteristics of a diverse workforce.
Skill Standard	Since many businesses are increasing the diversity of their workforce, it is important that a competent worker be able to define and recognize the characteristics of a diverse workforce. This would be accomplished if 4 characteristics of such a workforce were provided in a conversational situation. This could also be documented from a previous work experience or company-sponsored/selected training program.
WI 4 Skill	Identify organized labor's role in employee wages, benefits, and safety issues.
Skill Standard	Working as part of a group in a learning environment, develop a 200-word description of the role of an organized labor organization in wages, benefits, and safety issues. This description should be consistent with materials developed by various labor organizations.
WI 5 Skill	List steps of a grievance or dispute resolution procedures.
Skill Standard	Following the guidelines set forth in materials provided by organized labor, describe in written or oral manner the steps to be followed to resolve a dispute or grievance in a workplace with and organized workforce.
WI 6 Skill	Identify good personal ethical characteristics and behaviors.
Skill Standard ✔★	From a list of acceptable and unacceptable workplace behaviors, covering such things as punctuality, following directions, and cooperative behavior, properly identify all of the correct and incorrect behaviors.

WI 7 Skill	Demonstrate good personal ethics.
Skill Standard ✔★	Have documented and verified from a previous work or organized group activity, the ability to follow ethical behavior and ethics acceptable and approved by other members of the workforce or group.
WI 8 Skill	Identify good ethical business behavior.
Skill Standard ✔	To realize long term success in the workplace, a person must demonstrate commonly accepted good ethical business behavior. Therefore, a person must know what acceptable ethical behaviors includes and excludes. So, presented with a list of possible behaviors, the good and acceptable behaviors will be identified as such and unacceptable behaviors will also be identified. A good competent employee will be able to correctly identify 20 out of 25 from a provided list.
WI 9 Skill	Differentiate between good and poor business ethics practices.
Skill Standard ✔	Given examples of several good and poor ethical practices in the workplace, correctly select and identify properly those that are good and accepted and those that are poor practices and generally unacceptable in the workplace.
WI 10 Skill	Match employee responsibilities to employer expectations.
Skill Standard	Given lists of common expectations of manufacturing employers, and a range of employee responsibilities and actions, make a proper match between the items in the two lists.
WI 11 Skill	Define discrimination, harassment and equity.
Skill Standard	The individual will correctly define discrimination, harassment and equity within 2 minutes per definition and with 100% accuracy. To be documented by third party observation or written assessment.
WI 12 Skill	Demonstrate non-discriminatory behavior.
Skill Standard	Functioning in a real or simulated situation, receive feedback from other members of the group that non-discriminatory behavior has been demonstrated.

Workplace Skills

WS 1 Skill	Demonstrate consistently punctual arrival.
Skill Standard ✔	Given a specific start time by and employer, be at the scheduled work activity ready to begin by the predetermined time. Arrival at a specific time is important so planned activities can be accomplished and other employees are not kept waiting.
WS 2 Skill	Document regular attendance.
Skill Standard ✔	An individual will be able to document regular attendance with 100% accuracy for a period equal to their employment probation.
WS 3 Skill	Demonstrate enthusiasm and confidence about work and learning new tasks.
Skill Standard ✔	The individual will display confidence and enthusiasm for accepting the opportunity for new and challenging work assignments.
WS 4 Skill	Demonstrate safe, careful use, treatment and maintenance of tools, equipment and machines.
Skill Standard ✔	Given the tools and equipment used for an individual's job, show a supervisor or peer how to properly use and maintain each tool and piece of equipment.
WS 5 Skill	Demonstrate appropriate dress and hygiene for successful employment.
Skill Standard ✔	Describe minimal personal hygiene requirements, and given specific work environments, describe appropriate dress.
WS 6 Skill	Demonstrate the ability to act in a polite and respectful way towards co-workers.
Skill Standard ✔	In a group environment, interact with co-workers while displaying courtesy and respect .
WS 7 Skill	Demonstrate the ability to complete tasks on time and accurately.
Skill Standard ✔	Given a list of tasks in specific order with time deadlines and accuracy levels for each, complete in order, accurately and by the deadline.

WS 8 Skill	Demonstrate the ability to make career decisions.
Skill Standard	Alone or with family input, identify different job positions that would match personal and professional interests.
WS 9 Skill	Demonstrate the ability to use labor marker information.
Skill Standard	Analyzing current job availability and related information such as rate of pay, potential growth or decline and overall need for positions of this type.
WS 10 Skill	Prepare a resume and letter of application/interest.
Skill Standard	Gather necessary dates and information (transcript, employment history, references, and professional memberships) and prepare a resume listing each of the above in chronological order using the following format: Objective, Work experience, Education, Personal interests, References. Prepare a letter of application using standard-letter format and including the following information: the job position (if applicable) for which and individual is applying , and a few general paragraphs describing the interest in this position.
WS 11 Skill	Fill out an application for employment.
Skill Standard	Given a blank application form, fill in the blank areas legibly and correctly with the information requested.
WS 12 Skill	Participate in an employment interview.
Skill Standard	Dressed in appropriate interview attire, role-play a job interview with a human resource staff person at a company.
WS 13 Skill	Follow directions and procedures.
Skill Standard ✔	Given a set of directions or procedures (e.g. to clean up a work space, prepare something for shipping), follow each step and complete the task.
WS 14 Skill	Be depended on not to steal equipment and materials.
Skill Standard ✔	Given access to equipment and materials, an individual does not steal either equipment or materials.

WS 15 Skill	Be truthful in all communications with co-workers and supervisors.
Skill Standard	When placed in a situation where and individual must communicate either verbally or n written form with co-workers or supervisors, individual will not make false statements.
✔★	
WS 16 Skill	Accept constructive criticism.
Skill Standard	Given criticism of a task recently performed, appearance or conversation, and individual listens to the critical comments and either doesn't respond or responds in a conversational tone.
✔★	
WS 17 Skill	Demonstrate an ability to learn new skill and behaviors.
Skill Standard	Given a list of necessary new skills or behavior, describe the methodology that would be used for learning each new skill or behavior and then perform each skill and exhibit each changed behavior.
✔	
WS 18 Skill	Demonstrate a willingness to work.
Skill Standard	Given an assigned task the individual chooses to act in a timely manner to complete the assignment.
✔	
WS 19 Skill	Demonstrate the willingness to learn.
Skill Standard	Receive documentation from instructors or other group members that a willingness to learn new information or skills has been demonstrated.
✔	
WS 20 Skill	Work with minimal supervision.
Skill Standard	Demonstrate the ability and willingness to begin and follow tasks with little or no supervision, direction or prompting. This could have been demonstrated in school, community, workplace, scouting, social, or church activities.
✔★	
WS 21 Skill	Plan and organize work.
Skill Standard	Through successful accomplishment in organized activities such as community, church, school, community, or scouting, document the ability to plan and organize work both for individuals and groups such that the necessary work is successfully accomplished.
✔★	

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Learning Skills

LS 1 Skill	Identify personal preferred learning styles.
Skill Standard	Given the four possible learning styles and examples of a thinking skill and a performance skill, state whether you can best learn each through oral instruction or demonstration be another person; alone through reading the instruction manual or self- discovery. Individual must determine their personal learning style for thinking skills and performance skills.
LS 2 Skill	Demonstrate ability to learn new process steps.
Skill Standard ✔	Given a written description of a three-step process, demonstrate the ability to complete assembly. The produced assemble must match the specifications of the original assembly. Then one step in the process should be changed and the new assemble should be properly completed. This example could instead be for the mixing of powdered or liquid material instead of an assembly. This should be specific to the workplace context.
LS 3 Skill	Implement new process steps given oral instructions.
Skill Standard ✔	Given a product change and necessary new process steps, demonstrate the ability to follow the new oral instructions by properly completing the process.
LS 4 Skill	Read process instructions and implement appropriate steps.
Skill Standard ✔	Given a set of written instructions, read and interpret the appropriate steps and apply them to the process.
LS 5 Skill	Participate in product or process specific training and report significant information.
Skill Standard ✔	In a training environment, participate interactively (with team, instructor, equipment) and take motes during the training. This would be demonstrated by the fact that another individual not on the original training could successfully complete the process successfully.

Source: National Skill Standards for Manufacturing, 1331 Pennsylvania Ave. NW, Suite 1410 North, Washington DC 20004-1703